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A Mixed Methods Study to Investigate Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS)

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A dissertation submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Nursing.

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Abstract

The national burden of Neonatal Abstinence Syndrome on individuals, families, and the healthcare system has reached epidemic proportion. The rising incidence of Neonatal Abstinence Syndrome significantly impacts healthcare utilization and costs due to increases in Neonatal Intensive Care Unit admissions and length of hospitalization, to the possible detriment of maternal-infant bonding. Because nonpharmacologic nursing care is not complicated by the potentially harmful side effects of pharmacological treatment, it should be considered the standard of care for opioid-exposed infants; therefore, a comprehensive understanding of the barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome is needed.

This dissertation examines the benefits and factors associated with breastfeeding (a key nonpharmacological intervention) for the opioid-dependent maternal-infant dyad, factors associated with influencing healthcare providers' behaviors in the care of infants with Neonatal Abstinence Syndrome, and barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome. Findings from this study will inform the development of programs to improve nurses' implementation of nonpharmacological interventions and health and utilization outcomes in infants with Neonatal Abstinence Syndrome.

Keywords

Neonatal Abstinence Syndrome; neonatal withdrawal; Theoretical Domains Framework; nonpharmacological interventions; nursing interventions; length of stay

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Introduction

The burden of Neonatal Abstinence Syndrome (NAS) on individuals, families, and the healthcare system has reached epidemic proportions. NAS, a drug withdrawal syndrome that most frequently occurs in infants with intrauterine exposure to opioids (1), results in prolonged hospitalization and a wide array of deleterious symptoms requiring extensive pharmacological treatment (2). In 2016, the overall incidence rate of NAS was 6.7 per 1000 in-hospital births with hospital costs totaling $572.7 million (1). The majority of hospital costs (83%) were covered by Medicaid, indicating a disproportionate financial burden on state and federal budgets (1).

Admissions of infants with NAS to neonatal intensive care units (NICUs) increased from 7 per 1000 admissions in 2004 to 27 per 1000 admissions in 2013, with an associated increase in the average length of stay (LOS) from 13 to 19 days (3). In 2012, the average LOS for infants with NAS was 17 days and if pharmacologic treatment was required, the average LOS increased to 23 days (4). Prolonged hospitalization separates the mother from her infant during a critical time and impairs bonding, which is associated with negative developmental and behavioral outcomes (5).

On a national level, this epidemic significantly impacts healthcare systems, as studies have shown intrauterine exposure to opioids is associated with intrauterine growth restriction, congenital anomalies, prematurity, low birth weight, and NAS (6). In the US, the federal government introduced the 2015 Protecting Our Infants Act (S.799), with the objectives of improving NAS surveillance programs, addressing research gaps, and implementing effective measures for education, prevention, and treatment (7). The US

Department of Health and Human Services determined that gaps in research were related to "the most appropriate treatment and management of infants with NAS" (S.799). In response to this gap in research and to address the objectives of the Protecting Our Infants Act, the dissertation study presented in this compendium was designed to inform the development of programs to improve nurses' implementation of nonpharmacological interventions and health and utilization outcomes in infants with NAS.

The implementation of standardized protocols for NAS management is associated with decreased LOS and hospital costs (8,9). The American Academy of Pediatrics (AAP) Committee on Drugs recommends the establishment of an evidence-based protocol guiding the assessment and management of infants diagnosed with NAS or those at high risk for withdrawal (2). Although current NAS screening, assessment, and treatment methods have limitations, the AAP committee recommends all clinicians be educated on the application of validated withdrawal assessment tools (2). However, the assessment and care management of infants with NAS varies widely among hospitals in the US, and existing protocols have been based on minimal empirical data (10). In a recent survey of accredited US neonatology fellowship programs, only 55% had implemented a written NAS management protocol, and only 69% used a published abstinence scoring system to determine the severity of withdrawal and inform the treatment provided (11). In addition, new research findings are often not disseminated to clinicians and therefore not implemented into practice (12). As a result, infants with NAS may not receive the recommended course of treatment and may instead receive unnecessary, ineffective, or even harmful therapies (12).

Experts recommend treating the maternal-infant dyad as the standard of care as opposed to treating the infant with NAS alone (13-15). The nurse's role is to properly assess and interpret the infant's behaviors, determine how the mother understands and responds to her infant, and tailor interventions that help the mother care for her infant (16). However, even though nurses are well-positioned to have a positive influence on the maternal-infant dyad, they often exhibit judgmental behaviors because of negative stereotypes about opioid-dependent mothers (16). In addition, maternal feelings of fear, guilt, and shame related to drug use often limit the mother's ability to have honest conversations with nurses (17). Further, nurses often lack the required knowledge to provide optimal care to the maternal-infant dyad, a barrier that may also limit the development of nurse-mother relationships (18). To address these challenges, nurses providing care for infants with NAS should receive specialized training that addresses all facets of nursing care, including detailed information on adult addiction and drug use during pregnancy, maternal attachment behaviors, encouragement of appropriate maternal behavior, and breastfeeding when appropriate (17,19). This dissertation study is significant because findings can inform the development and implementation of specialized programs for nonpharmacological nursing interventions to improve outcomes for the maternal-infant dyad, such as supporting breastfeeding when appropriate, caring for the maternal-infant dyad, and promoting nurse-mother relationships (16,19,20).

Specific Aims

This dissertation examines nurses' perceptions of barriers and enablers to implementation of nonpharmacological interventions for infants with NAS. The three

manuscripts included in this study identify strategies for nurses to implement best practice standards, nonpharmacological interventions, and clinical practice guidelines (CPGs) in the care of infants with NAS and their families.

Aim 1: Examine benefits and factors associated with breastfeeding (a key nonpharmacological intervention) for the opioid-dependent maternal -infant dyad.

The first manuscript is a scoping review to explore what is known about the benefits of maternal breastmilk for the opioid-dependent maternal-infant dyad and to evaluate factors related to breastfeeding implementation by opioid-dependent maternal-infant dyads guided by the SEM. The key findings from this scoping review identified the importance of treating the infant with NAS as part of the maternal-infant dyad. Despite recommendations for mothers in treatment to breastfeed their infants, many barriers prevent mothers of infants with NAS from breastfeeding. Further, intentional, multi-level interventions aimed at creating a more secure, compassionate, and comfortable environment for the NAS maternal-infant dyad enhances outcomes for both mother and infant.

Aim 2: Explore factors associated with influencing healthcare providers' behaviors in the care of infants with NAS.

The second manuscript is an integrative review, guided by the Whittemore and Knafl methodology (21), on the current knowledge of the individual and contextual factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions to decrease LOS for infants with NAS through the lens of the TDF. Key findings included: implementing evidence-based CPGs, which have

been shown to increase identification of infants with NAS, decrease NAS severity using the Finnegan scoring tool, and decrease LOS; providing specialized training for healthcare providers; including parents as integral care team members; utilizing standardized withdrawal scoring tools; and including multidisciplinary care team members in the care of infants with NAS to enhance overall outcomes for infants and their families. In addition, the findings from the integrative review identified key influential TDF domains which were further explored in the dissertation study.

Aim 3: Investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS.

The third and final manuscript is a convergent parallel mixed methods study, conducted through the lens of the TDF, which identified and prioritized barriers and enablers of nurses' implementation of nonpharmacological interventions for infants with NAS. The findings from this study will inform the development of programs to improve nurses' implementation of nonpharmacological interventions in the care of this vulnerable and rapidly growing patient population: the infant diagnosed with NAS.

Innovation

This parallel convergent mixed methods dissertation study exhibits two primary innovations. It is the *first* to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS. A comprehensive representation of nurses' perspectives on the barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS was obtained through administration of a tailored Determinants of Implementation Behavior Questionnaire

(DIBQ-NAS) to members of the National Association of Neonatal Nurses (NANN) and semi-structured interviews with nurses. A *second source of innovation* is that this study was the first to utilize the Theoretical Domains Framework (TDF) to guide the exploration of nurses' implementation of nonpharmacological interventions for infants with NAS. The TDF provided a structure for assessing and evaluating the factors that affect the behavior of healthcare providers and the implementation of evidence-based practice (22, 23).

Theoretical Framework

The developers of the TDF identified 33 theories and 128 key theoretical constructs associated with *behavior change* and synthesized them into one framework that can be used to guide theoretical assessment of implementation problems, as well as professional and other health-related behaviors as a basis for intervention development (22). *Knowledge*, *Skills*, and *Social/Professional Role and Identity* are the domains with greatest influence on providers' implementation of nonpharmacological interventions to decrease the LOS for infants with NAS (24). The *Knowledge* domain of the TDF includes the following constructs: knowledge, knowledge about condition/scientific rationale, schemas + mindsets + illness representations, and procedural knowledge (25). The *Skills* domain of the TDF includes the following constructs: skills, competence/ability/skill, assessment, practice/skills development, interpersonal skills, and coping strategies (25). The *Social/Professional Role and Identity* domain of the TDF includes the following constructs: identity, professional identity/boundaries, role, group/social identity, social/group norms, and alienation/organizational commitment (25). In the integrative

review, the primary themes identified within these domains included: knowledge of NAS and AAP (American Academy of Pediatrics) recommendations regarding the management of NAS, nursing competence (assessment skills and effective utilization of the Finnegan scoring tool), development of interpersonal relationships with parents within professional boundaries, establishment of role within a multidisciplinary team, and leadership in the management and care of infants with NAS. In addition to the *Knowledge*, *Skills*, and *Social/Professional Role and Identity* domains, this study investigated other influential contextual and environmental domains, such as *Beliefs about Capabilities*, *Environmental Context and Resources*, *Organization*, and *Emotion*, related to infants with NAS and the nurses who care for the NAS maternal-infant dyad.

Research Approach

In preparation for this dissertation study, a scoping review was conducted to explore benefits of maternal breastmilk and to evaluate factors related to breastfeeding implementation by opioid-dependent maternal-infant dyads guided by the Social Ecological Model (SEM). In addition, a small pilot study was conducted to explore nurses' and other key interdisciplinary team members' perceptions of the treatment plan and care provided for infants with NAS. The findings from the pilot study were used to inform and further refine the research design and methods for this dissertation study.

Further, an integrative review (24), guided by the constructs of the TDF, was completed which focused on factors influencing healthcare providers' behaviors in the care of infants with NAS. *Knowledge*, *Skills*, and *Social/Professional Role and Identity* were identified as being the most influential domains relevant to modifying healthcare

providers' behaviors surrounding implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS.

Finally, the dissertation study conducted through the lens of the TDF identified and prioritized barriers and enablers of nurses' implementation of nonpharmacological interventions for infants with NAS. The findings from this study will inform the development of programs to improve nurses' implementation of nonpharmacological interventions and health and utilization outcomes in infants with NAS.

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Manuscript 1

A Scoping Review of the Benefits of Breastmilk for the

Methadone Dependent Maternal-Infant Dyad

Abstract

Due to a significant increase in the number of infants diagnosed with neonatal abstinence syndrome, it is important to develop a more comprehensive understanding of the health implications of breastmilk provided by the mother. Therefore, the purpose of this scoping review of literature is to explore what is known about the benefits of maternal breastmilk for the opioid-dependent maternal-infant dyad, and to evaluate factors related to breastfeeding implementation by opioid-dependent maternal-infant dyads guided by the Social Ecological Model. The Social Ecological Model for health promotion is utilized as the theoretical framework for this study because it supports the concept of developing health promotion interventions that focus on the person and environment. Results of this review may provide knowledge to inform future interventions and assist in the development and implementation of best practice standards, clinical practice guidelines, and protocols to mitigate barriers that prevent opioid-dependent mothers from breastfeeding. The need for extensive support must be emphasized to ensure high initiation rates and long duration of breastfeeding, when appropriate, to improve the care of this vulnerable and rapidly-growing patient population: the neonatal abstinence syndrome maternal-infant dyad.

Keywords

Neonatal Abstinence Syndrome; Neonatal Withdrawal; Methadone; Social Ecological Model; Breastmilk; Breastfeeding; Maternal-Infant Bond; Length of Hospitalization

Introduction and Background

The number of expectant mothers using opiates rose nearly five-fold from 2000 to 2009 (Patrick et al., 2012). Among neonates with in-utero exposure to opioids, an estimated 60%-90% experience drug withdrawal, a condition defined as Neonatal Abstinence Syndrome (NAS) (Ebner et al., 2007). NAS is characterized by a wide array of signs and symptoms, including increased irritability, hypertonia, tremors, feeding intolerance, emesis, watery stools, seizures, and respiratory distress, often requiring prolonged hospitalization and extensive pharmacological therapy (American Academy of Pediatrics Committee on Drugs, 1998). The use of pharmacological therapies is supported by an extensive body of research that indicates opiates should be first-line treatment for infants with NAS (American Academy of Pediatrics Committee on Drugs, 1998). Currently, methadone maintenance therapy is the standard of care for mothers dependent on opiates during the perinatal period and the only pharmaceutical treatment recommended in the United States (Jarvis & Schnoll, 1994; National Consensus Development Panel on Effective Medical Treatment of Opiate Addiction, 1998). Methadone maintenance therapy has successfully decreased the use of other opiates and illicit drugs and the risk of infant loss, while increasing utilization of prenatal care and substance abuse counseling (Jones et al., 2010).

Although mothers undergoing methadone maintenance therapy have been discouraged from breastfeeding in the past if the maternal methadone dose was above 20mg/day, the American Academy of Pediatrics (in 2001 and 2013) no longer lists methadone at any dose as a breastfeeding contraindication. The nutritional and

immunologic benefits of breastmilk for optimal health and development for all infants are well established (World Health Organization, n.d.). And while there is limited research on how maternal breastmilk augments pharmacologic treatment in infants with NAS, studies suggest ingestion of maternal breastmilk may be an independent predictor of favorable response to methadone therapy for infants with NAS (Isemann, Meinzen-Derr, & Akinbi, 2010; Welle-Strand et al., 2013; O'Connor, Collett, Alto, & O'Brien, 2013). In fact, breastfeeding has been shown to act as an analgesic for infants and is an established method for soothing agitated infants, thus potentially improving withdrawal symptoms in infants with NAS (Gray, Miller, Philipp, & Blass, 2002).

Some research findings have shown that women who have breastfed and those who have breastfed for longer periods of time have experienced less postpartum depression (U.S. Department of Health and Human Services [DHHS], 2011). For women with a history of substance abuse and prior psychiatric comorbidities, such as anxiety, depression, bipolar disorder, or attention-deficit/hyperactivity disorder, a reduction in the risk of postpartum depression may be critical (Pritham, 2013) because the connection between opioid dependence and co-occurring psychiatric symptoms in pregnant women who receive methadone maintenance therapy is significant (Benningfield et al., 2010).

The immediate effects of skin-to-skin contact and breastfeeding on maternal bonding may deter maternal substance abuse relapse and enhance infant development (Pritham, 2013). Early skin-to-skin contact after birth encourages breastfeeding and has positive effects on maternal feelings toward their infant (AAP, 2012). Skin-to-skin contact and breastfeeding stimulate the release of oxytocin in the mother's brain, which

elicits maternal parenting behaviors (Moore, Anderson, & Bergman, 2007; Nagasawa, Okabe, Mogi, & Kikusui, 2012). When oxytocin is released, pain, stress, and anxiety behaviors are lessened, which allows the mother to be more attentive to her infant (Nagasawa et al., 2012). In addition, the bonding that develops as a result of skin-to-skin contact and breastfeeding provides the encouragement to continue breastfeeding, thereby establishing lifelong health benefits for the mother and infant (Pritham, 2013).

Despite all the benefits breastfeeding offers to this population, breastfeeding initiation among women in methadone treatment programs is low, with reports ranging from 24%-46%, compared with the national initiation rate of 77% (Wachman, Byun, & Philipp, 2010; CDC, 2012). In addition, lactation among women in methadone treatment programs (Jansson, 2009) and maternal perceptions of the decision to breastfeed the infant with NAS have been understudied. Due to a significant increase in the number of infants diagnosed with NAS, it is important to develop a more comprehensive understanding of the health implications of breastmilk provided by the mother. Therefore, the purpose of this scoping review of literature is:

1. To explore what is known about the benefits of maternal breastmilk for the opioid-dependent maternal-infant dyad.
2. To evaluate factors related to breastfeeding implementation by opioid-dependent maternal-infant dyads guided by the Social Ecological Model (SEM).

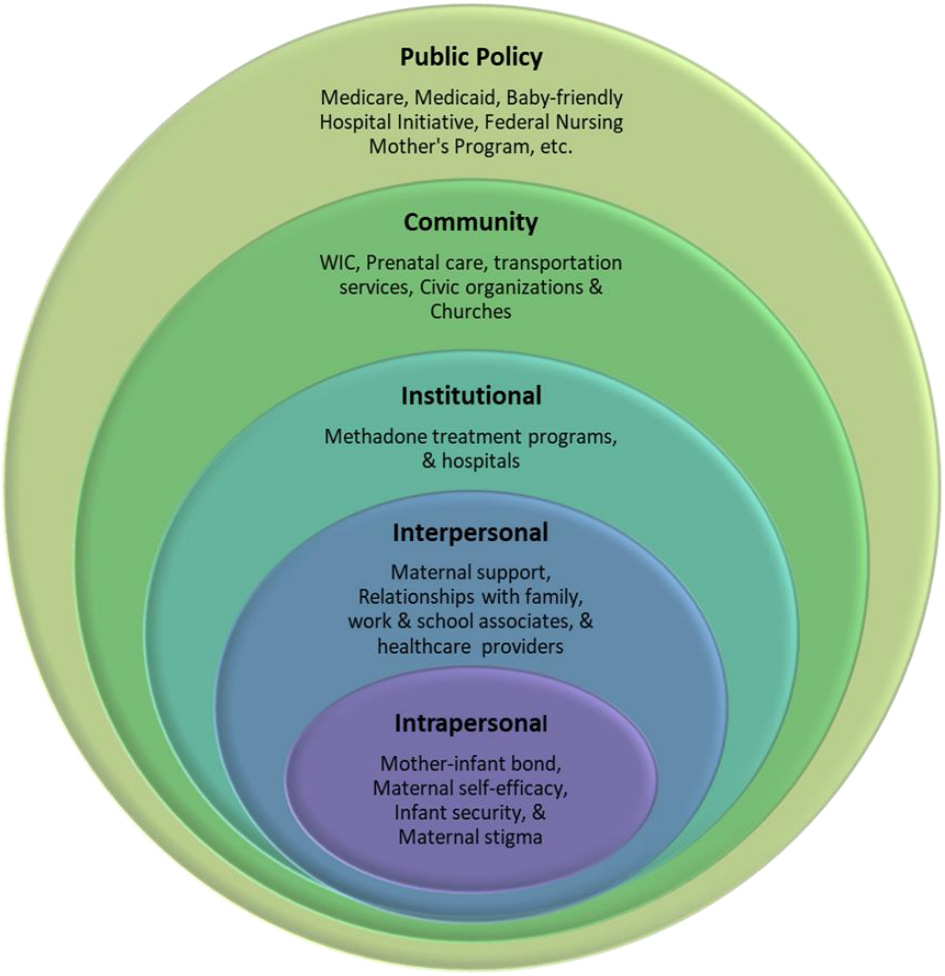
Theoretical Framework

The Social Ecological Model (SEM) for health promotion is utilized as the theoretical framework for this study because it supports the concept of developing health promotion interventions that focus on the person and environment (McLeroy, Steckler, Bibeau, & Glanz, 1988). The SEM model posits that "appropriate changes in the social environment will produce changes in individuals, and that the support of individuals in the population is essential for implementing environmental changes" (McLeroy et al., 1988, p. 351). The SEM intent is to mitigate unhealthy behaviors by aiming interventions at several determining factors: intrapersonal (characteristics of individual, attitudes, and behaviors); interpersonal (social support system including family, work associates and friends); institutional (social institutions with organizational structure); community (relationships among organizations, and informal networks within defined boundaries); and public policy (local, state, national laws and policies) (McLeroy et al., 1988).

Figure 1 represents the relationship between the maternal-infant dyad and the five levels of influence of the SEM. Applying the SEM is the first step in learning the best methods for changing the environment to improve health. The intrapersonal factor corresponds to the bond between mother and child, maternal self-efficacy, infant security, and perceived maternal stigma. The interpersonal factor relates to maternal support, family relationships, relationships developed through employment and/or education, and relationships with healthcare providers. The institutional factor corresponds to the maternal methadone inpatient treatment program, the hospital nursery where the infant is admitted (while receiving care for Neonatal Abstinence Syndrome), and maternal hospitalization. The community factor relates to the support the mother receives from

community resources, such as, WIC (Women, Infants, and Children: Food and Nutrition Service), prenatal care, and transportation services. The public policy factor corresponds to policies that are aimed at supporting vulnerable populations (mother-infant dyad), such as Medicare and Medicaid. Many governmental policies and programs have been created to encourage breastfeeding, such as the implementation of the Baby Friendly Hospital Initiative (BFHI) and the Federal Nursing Mother's Program. Effective multi-level interventions should aim to create conditions that allow the parent(s) to provide a safe, nurturing, and stimulating environment for their infant.

Figure 1



Methods

A scoping study is utilized when a specific research question has not been identified and the intent is to review broader topics, regardless of study design (Arskey & O'Malley, 2005). Arskey and O'Malley (2005) developed a specific approach to increase reliability of findings and methodological rigor (Mays, Roberts, & Popay, 2001). This five-stage process was utilized in conducting this scoping study. The Arskey and O'Malley (2005) methodological framework includes establishing a research question; determining pertinent studies; refining the selection of literature; charting the data; and collating, summarizing and reporting the results.

During a consultation with a reference librarian at an academic medical center, the following electronic databases were determined to be the most appropriate for this scoping study: Scopus, PubMed, and EBSCOhost (see table 1). Each database was searched utilizing the following terms: "*Breastfeeding*" and "*Methadone*."

Table 1

Available databases on the EBSCOhost platform

EBSCOhost databases
CINAHL Complete; Academic Search Premier; Agricola; Alt HealthWatch; Newswires; Applied Science & Technology Full Text (H.W. Wilson); CINAHL Plus with Full Text; Computer Source; Criminal Justice Abstracts with Full Text; eBook Collection (EBSCOhost); Education Full Text (H.W. Wilson); ERIC; European Views of the Americas: 1493 to 1750; Fuente Académica; Funk & Wagnalls New World Encyclopedia; GreenFILE; Health Source - Consumer Edition; Health Source: Nursing/Academic Edition; History Reference Center; Library Literature & Information Science Index (H.W. Wilson); Library, Information Science & Technology Abstracts; MAS Ultra - School Edition; MasterFILE Premier; MEDLINE; Middle Search Plus; Military & Government Collection; Newspaper Source Plus; Primary Search; Professional Development Collection; PsycARTICLES; Psychology and Behavioral Sciences Collection; PsycINFO; Regional Business News; Religion and Philosophy Collection; Science Reference Center; Teacher Reference Center; TOPICsearch; Vocational and Career Collection; Web News; AHFS Consumer Medication Information; American Doctoral Dissertations, 1933 - 1955; eBook Academic Collection (EBSCOhost); Consumer Health Complete - EBSCOhost;

The inclusion criteria for the articles were the following: the English language, peer reviewed journals, humans, and published between 2005 and 2019. The reference lists of selected articles were also examined for principal sources and additional pertinent articles.

During the first search of the electronic databases, 138 articles were retrieved. After citations were reviewed, 52 articles were determined to be duplicates and therefore removed. The remaining 86 articles' abstracts were examined for relevance based on the inclusion and exclusion criteria. Research articles specific to the benefits of breastmilk for Neonatal Abstinence Syndrome infants and the maternal health benefits of breastfeeding were included. Articles that contained findings extraneous to infant and maternal health were excluded (n = 44). Of the remaining 42 full-text articles, 10 studies met the inclusion criteria for the study sample.

A PRIMSA flow diagram of this process was developed (Appendix A) (Moher, Liberati, Tetzlaff, & Altman, 2009) as The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was utilized in selecting articles that were included in the study sample. In addition, a scoping review matrix (Appendix B) was created to organize the selected articles by author, date, study purpose, study design, level of evidence, setting, sample description, size, data collection methods, results, and limitations, therefore completing Stage 4 of Arskey and O'Malley's methodological framework. The SEM was utilized to complete Stage 5 of the Arskey and O'Malley methodological framework (2005).

Results

The studies that met the inclusion and exclusion criteria (n = 10) were primarily conducted in substance abuse treatment centers and hospitals; one study utilized a qualitative, focus group design, one study utilized a three-part cohort design, six studies utilized retrospective chart reviews, and two studies utilized a systematic review. The studies utilized historical maternal and neonatal data, interviews, case note reviews, the Finnegan NAS scoring tool, and literature reviews as data collection methods. A majority of the peer-reviewed articles addressed the effects of feeding methods (specifically breastfeeding) on the severity of NAS, management and treatment of NAS, and the maternal experience of breastfeeding while receiving methadone treatment.

Social Ecological Model

Although none of the selected studies utilized the SEM as the framework for the design, a majority of the studies specifically addressed the intrapersonal level of influence (n = 8), interpersonal level (n = 1), institutional level (n = 5), community level (n = 2), and public policy level (n = 2) (see table 2). None of the selected studies referenced the incorporation of a specific theory, framework, or model.

Table 2

Author, Date	Study Purpose	SEM Level	SEM Influential Factors
Abdel-Latif et al., 2006	To assess the effects of breastmilk on the severity and outcome of NAS	**Intrapersonal**	Maternal-infant bond, maternal self-efficacy, & infant security
Bagley et al., 2014	To examine evidence for NAS tools, nonpharmacological interventions, & pharmacological management of opioid-exposed infants	**Intrapersonal** **Institutional**	Maternal-infant bond, maternal self-efficacy, & infant security Hospital protocols and clinical practices

Demirci et al., 2015	To explore the perceptions surrounding breastfeeding decisions and management among pregnant and postpartum women taking methadone	**Intrapersonal** **Interpersonal** **Community**	Maternal-infant bond, maternal self-efficacy, infant security, & maternal stigma Maternal support, relationships with family and peers WIC, prenatal care, & community support services
Dryden et al., 2015	To investigate factors associated with the development of NAS and to assess the implications for healthcare resources of infants born to drug-misusing women	**Intrapersonal** **Community**	Maternal-infant bond, maternal self-efficacy, & maternal stigma Community support services & outpatient clinic care
Hodgson et al., 2012	To explore the effect of a rooming-in protocol on the need to treat withdrawal in the opioid-exposed infant	**Intrapersonal** **Institutional**	Maternal-infant bond & maternal self-efficacy Rooming-in program within hospital setting
Isemann et al., 2011	To identify maternal and neonatal factors that impact response therapy for NAS	**Intrapersonal**	Maternal-infant bond, maternal self-efficacy, & infant security
McQueen et al., 2011	To determine whether NAS scores of infants exposed to methadone *in-utero* differed by infant feeding method	**Intrapersonal** **Public Policy**	Maternal-infant bond, maternal self-efficacy, & infant security Policies regarding methadone and breastfeeding to assist health care providers and mitigate discrimination
Pritham, 2013	To review literature regarding the association of breastfeeding and NAS severity, need for pharmacological therapy, and length of stay	**Institutional**	Provision of education by healthcare providers in the hospital/nursery setting
Wachman et al., 2010	To determine breastfeeding rates among opioid-dependent women	**Institutional**	Breastfeeding barrier: Methadone treatment

	giving birth in a Baby-friendly Hospital	**Public Policy**	programs Hospital protocol/policy: Breastfeeding and Illicit Drug Use Guidelines
Welle-Strand et al., 2013	To examine the rate and duration of breastfeeding in a cohort of women in opioid maintenance therapy and the effect of breastfeeding on the incidence and duration of NAS	**Intrapersonal** **Institutional**	Maternal-infant bond, maternal self-efficacy, & infant security Provision of education by healthcare providers in the hospital/nursery setting

Intrapersonal Factors

Intrapersonal factors were found to have the most significant impact on the health outcomes of the mother and infant as they directly correspond to maternal-infant bonding, maternal self-efficacy, infant security, and maternal stigma. A majority of the studies focused primarily on the intrapersonal factors related to the initiation of breastfeeding in the opioid-dependent maternal-infant dyad.

Abdel-Latif et al. (2006) addressed the intrapersonal factor of the SEM, finding that mothers who elected to breastfeed were more likely to have received antenatal care, or to admit to less polydrug use, and were less likely to be identified to child welfare services as an at-risk parent, potentially enabling the mother to effectively soothe her infant thereby reducing the infant's Finnegan withdrawal scores. Abdel-Latif et al. (2006) also found that fewer infants who received maternal breastmilk required pharmacologic treatment for withdrawal (52.9% versus 79%, $p < .001$) and the average time to withdraw occurred significantly later in infants who received maternal breastmilk compared with

those who received formula (10 days versus 3 days; $p < .001$). In addition, the amount of morphine administered for withdrawal was considerably lower in infants who received maternal breastmilk compared with those who received formula (Abdel-Latif et al., 2006). The overall treatment duration was approximately 20 days less for infants who received maternal breastmilk (Abdel-Latif et al., 2006).

Bagley, Wachman, Holland, and Brogly (2014) found similar results in a systematic review. Their findings indicated that breastfed infants experienced an overall decrease in pharmacological treatment, length of pharmacological treatment (if required), NAS scores, and length of hospitalization. Dryden, Young, Hepburn, and Mactier (2009) determined that breastfeeding for 72 hours or greater was independently associated with decreasing the odds of the infant receiving pharmacological therapy for NAS by half. These findings are congruent with the results of a retrospective chart review conducted by Hodgson and Abrahams (2012) indicating that breastfeeding corresponded with a decrease of 79% ($p < .001$) in the odds of the infant receiving morphine therapy. In a retrospective review, Isemann, Meinzen-Derr, and Akinbi (2011) also determined maternal breastmilk feedings were associated with a shorter duration of pharmacological therapy and length of stay compared with formula fed infants (12.5 days versus 18.5 days, $p = 0.01$). Similarly, in a cohort study Welle-Strand et al. (2013) found methadone-exposed infants receiving breastmilk had a significantly lower incidence of NAS requiring pharmacological treatment (53%) than methadone-exposed infants not receiving breastmilk (80%). Welle-Strand et al. (2013) also found breastfed infants had a shorter duration of pharmacological therapy for NAS (28.6 days) compared with infants

who were not breastfed (46.7 days, $p < 0.05$). Reducing the length of stay for infants with NAS is critical because having the infant at home will enhance the maternal-infant bond while providing a more natural environment conducive to breastfeeding (McQueen et al., 2011).

Despite these potential benefits, barriers to breastfeeding, including concern of transfer of hepatitis C to the infant through breastmilk may discourage mothers and providers from pursuing breastfeeding in this population. These barriers include perceived lack of time to breastfeed due to other responsibilities as well as concerns over not having "enough" breastmilk, of infant latching difficulty, and of an infant receiving too much methadone through the transfer of breastmilk (Demirci, Bogen, & Klionsky, 2015). However, in their qualitative focus group study of seven pregnant women and four postpartum women receiving methadone maintenance therapy, Demirci et al. (2015) found that motivating factors may help to overcome these barriers. Motivating factors included the potential for enhanced maternal-infant bonding, perceived health benefits for mother and infant, and a means of mitigating infant discomfort related to NAS symptoms.

Interpersonal Factors

Interpersonal factors correspond to maternal support, relationships with family members, relationships with work and school associates, and relationships with healthcare providers. These interpersonal factors have been shown to influence the implementation of breastfeeding in the vulnerable opioid-dependent maternal-infant dyad. Demirci et al. (2015) identified the mother's own mother as a source of

breastfeeding knowledge and support; however, partners were perceived as sources of both support and anxiety regarding the decision to breastfeed. The participants in the study also identified peers as influential in their decision to breastfeed (Demirci et al., 2015).

Institutional Factors

Several studies addressed the institutional factors that directly correspond to methadone treatment programs and hospitals. In a systematic review, Bagley et al. (2014) addressed the institutional factor of the SEM by recommending that hospitals align clinical practices with standard protocols including the use of valid assessment measures, accepted pharmacologic treatment (morphine and methadone), and specific training for those delivering infant care. Evidence from two other studies suggests providing education addressing the benefits of breastfeeding along with practical instruction on the mechanics of breastfeeding may increase initiation rates (Pritham, 2013; Welle-Strand et al., 2013). Bagley et al. (2014) posited that mothers in treatment programs may have access to other healthcare services including counseling, infection screening, and fetal growth monitoring, thereby enhancing maternal and infant outcomes. However, mothers in treatment programs are also often required to attend group meetings, individual therapy sessions, and make daily trips to the treatment center for medication and drug testing, thereby limiting time with their infant (Wachman, Byun, & Philipp, 2010).

Another potential method to improve breastfeeding initiation rates in this maternal-infant dyad is the development of a rooming-in program within the hospital setting. In a retrospective chart review, Hodgson and Abrahams (2012) examined a

rooming-in program to mitigate the need to treat infants for opiate withdrawal. Their findings suggest that rooming-in is a safe alternative to the current standard of care that separates mother and infant because it allows the mother to care for her infant and provides an environment conducive to breastfeeding thereby enhancing the maternal-infant bond (Hodgson & Abrahams, 2012).

Community Factors

Two studies addressed the community factors that directly correspond to WIC, prenatal care, transportation services, and civic organizations. Dryden et al. (2009) conducted a retrospective cohort study addressing the implications for healthcare and community resources dedicated to this vulnerable maternal-infant dyad. They posited that the majority of drug-misusing mothers electing not to breastfeed did so due to "deeply engrained social prejudices and not because of polydrug misuse" (Dryden et al., 2009, p. 669). Dryden et al. (2009) found that outpatient follow-up care was often unutilized by this population due to their challenging and complex lifestyles. This finding suggests the need for providing community support services with increased efforts to facilitate interdisciplinary communication among service providers (Dryden et al., 2009).

The need for community support services is further emphasized by the findings of Demirci et al. (2016) as women in methadone therapy obtained breastfeeding information and misinformation within the health care community from WIC counselors and internet resources; however, prenatal care providers rarely addressed breastfeeding.

Public Policy

While none of the studies in this scoping review specifically addressed the role of public policy as it related to the initiation of breastfeeding in the opioid-dependent maternal-infant dyad, many of the studies collectively suggested that agency policies regarding breastfeeding and methadone are needed to assist health care providers as they deliver evidence-based care to mothers in methadone treatment who desire to breastfeed. In addition, establishing breastfeeding policies for the opioid-dependent maternal-infant dyad may mitigate the potential for discrimination based on the mothers' use of methadone (McQueen et al., 2011).

Wachman et al. (2010) discussed a hospital's development of a multidisciplinary task force aimed at creating *Breastfeeding and Illicit Drug Use Guidelines*. The intent of the guidelines was to provide consistent care with an emphasis on the importance of maternal sobriety and the provision of all possible supports for mothers choosing to breastfeed.

Discussion

The primary finding of this scoping review is that, when possible, and if not otherwise contraindicated, mothers who adhere to a supervised drug treatment program should be encouraged to breastfeed as long as the infant continues to gain weight (Abdel-Latif et al., 2006; Bagley et al., 2014; Demirci, et al., 2015; Dryden et al., 2009; Isemann et al., 2011; McQueen et al., 2011; Pritham, 2013). Most of the studies included in this review show that breastfeeding has been associated with less severe NAS that presented later and required less frequent pharmacologic intervention, which resulted in fewer hospital days for the infant (Abdel-Latif et al., 2006; Bagley et al., 2014; Hodgson &

Abrahams, 2012; Isemann, et al., 2011; McQueen et al., 2011; Pritham, 2013; Welle-Strand et al., 2013). Findings from published studies indicate that unnecessary pharmacologic treatment will prolong drug exposure and the duration of hospitalization to the possible detriment of maternal-infant bonding (Abdel-Latif et al., 2006; Hudak & Tan, 2012; McQueen et al., 2011; Pritham, 2013). The findings also indicate that breastfeeding provided optimal nutrition, promoted bonding, and empowered babies' mothers to be effective parents (Legatte, 2008; Jambert-Gray et al., 2009; Jansson et al., 2008; McQueen et al., 2011). In addition, Bagley et al. (2014) suggested that breastfeeding and allowing the maternal-infant dyad to "room-in" increased bonding and normalized the postpartum experience for mothers who may have felt vulnerable and stigmatized due to their history of opioid dependence.

Demirci et al. (2015) identified peers as influential in maternal breastfeeding decisions. This finding aligns with previous studies that suggest breastfeeding peer support programs can increase breastfeeding initiation rates, duration, and exclusivity, particularly for women who share unique breastfeeding concerns, such as those receiving methadone treatment (Britton, McCormick, Renfrew, Wade, & King, 2007; Chung, Raman, Trikalinos, Lau, & Ip, 2008; Fairbank et al., 2000). The most effective programs included breastfeeding training, health care provider involvement, early support, and peer assistants who shared a similar socio-economic background as the mothers they counseled (Centers for Disease Control and Prevention, 2013).

Literature Gaps

The vulnerable population of the maternal-infant dyad has unique benefits to gain from breastfeeding due to the emotional, behavioral, and medical complications that often affect them; however, lactation among women in methadone treatment programs has been understudied (Jansson, 2009). Further, research dedicated to understanding maternal perceptions of the decision to breastfeed the NAS infant is lacking, as is research utilizing large-scale studies examining the effects of breastmilk on the severity of NAS as determined by a quantitative withdrawal scale (Abdel-Latif et al., 2006). Also, there is limited data on the inter-observer reliability of NAS assessment tools due to lack of a standardized approach (Bagley et al., 2014). As Demirci et al. (2015) suggest, future researchers should examine the feasibility and effectiveness of peer-based lactation support within methadone treatment centers and hospitals caring for infants with NAS. Isemann et al. (2011) argue that studies are needed to identify infants at risk for rebound NAS, including correlation with serum (methadone) concentrations in breastmilk. Finally, in future studies researchers should examine health care providers' perceptions regarding breastfeeding and mothers in methadone treatment programs.

Limitations

This scoping review provides a general overview of the available literature related to the benefits of breastmilk for the opioid-dependent maternal-infant dyad and factors related to breastfeeding implementation as guided by the SEM. Due to specific inclusion and exclusion criteria, this scoping review is not inclusive of all available literature related to this study topic. Also, a second researcher was not available to assist with the literature review process and mitigate researcher bias as recommended by Arksey and

O'Malley (2005). Finally, due to the utilization of specific search terms in the initial inquiry, additional articles related to the study topic may not have been discovered during this scoping review.

Conclusions

As illustrated by the evidence included within this review, it is important to consider the infant with NAS as part of a maternal-infant dyad as treatment for the infant does not occur in isolation from the mother. Despite the recommendations for mothers in treatment to breastfeed their infants, many barriers exist that prevent these mothers from breastfeeding, including inconsistent advice from health care providers; lack of clear guidelines; feeding problems (related to NAS); lengthy hospital stays that prohibit maternal-infant bonding; and issues such as low self-esteem, lack of knowledge, or feelings of maternal guilt (Dryden et al., 2009; McQueen et al., 2011; Jansson, Velez, & Harrow, 2004). Health care providers must understand current guidelines for breastfeeding among mothers in methadone treatment and offer these women nondiscriminatory and supportive counsel regarding common breastfeeding barriers and maternal concerns (Demirci et al., 2014). The need for extensive support must be emphasized to ensure high initiation rates and long duration of breastfeeding, when appropriate, for the benefit of the maternal-infant dyad. There is a critical need for more research concerning the effect of breastfeeding on infants with NAS, particularly studies that focus on the mother's perception of the decision to breastfeed her infant. In addition, intentional, multi-level interventions aimed at creating a more secure, compassionate, and comfortable environment for the maternal-infant dyad will likely enhance outcomes for

both mother and infant. Due to the significant increase in infants diagnosed with NAS, those who care for these infants should utilize a standardized, objective, and validated tool to guide the treatment of NAS. These strategies will ensure consistent, quality care for this vulnerable maternal-infant dyad.

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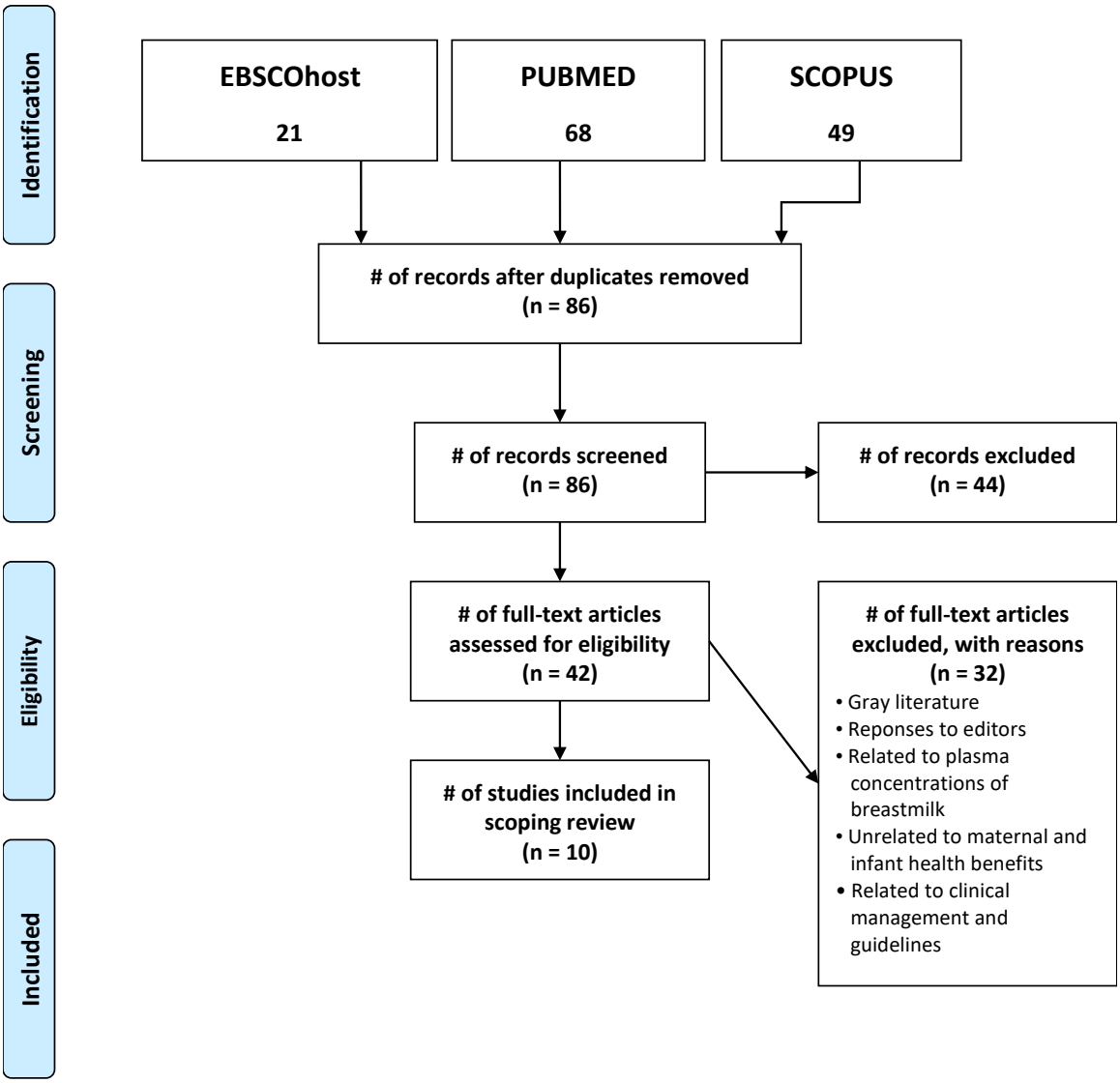
Appendix A – PRISMA Diagram

PRISMA 2009 Flow Diagram
Key Terms: "Breastfeeding" and "Methadone"
Literature limitations: 2005 to 2019, humans, English language, peer reviewed journals

A Scoping Review of the Benefits of Breastmilk for the Methadone Dependent Maternal-Infant Dyad



Appendix B – Scoping Review Matrix

Author, Date	Study Purpose	Study Design	Level of Evidence	Setting	Sample Description, Size	Data Collection Methods	Results	Limitations
Abdel-Latif et al., 2006	To assess the effects of breast milk on the severity and outcome of neonatal abstinence syndrome	Retrospective Chart Review	Descriptive Statistics	Hospital in Australia	190 drug-dependent mother and infant pairs.	Finnegan's scoring tool : Assesses the CNS, GI, Respiratory, and selected autonomic symptoms (e.g. yawning, sneezing, sweating). Tool consists of 30 items across 21 categories.	Breast milk significantly ameliorates the severity of NAS. Infants who were fed primarily breast milk had significantly reduced mean NAS scores, delayed onset of withdrawal, a decreased need for medication, and shorter hospitalization that formula-fed infants.	Inability to identify nonopiate effects (cocaine, amphetamines, etc.) as no tool is available presently, as the Finnegan scoring system is only validated for opiate withdrawal.
Bagley, et al., 2014	Review of the assessment and management of neonatal abstinence syndrome	Systematic Review	Assessment of NAS, nonpharmacologic interventions for NAS, and pharmacologic treatment for NAS.	Various hospitals and municipalities	8 studies were included for NAS assessment, 13 studies were included for nonpharmacologic interventions, and 7 studies were reviewed for pharmacologic management.	Literature Review	Nonpharmacologic interventions, particularly breastfeeding, may decrease NAS severity. Opioid medications, such as, morphine or methadone are recommended first-line therapy, with phenobarbital or clonidine as second-line adjunctive therapy.	There is limited data on the inter-observer reliability of NAS assessment tools due to lack of a standardized approach.
Demirci, et al., 2015	Breastfeeding and Methadone Therapy: The Maternal Experience	Qualitative Focus Group Design	semistructured interviews and focus groups	Treatment center	7 pregnant women and 4 postpartum women enrolled in methadone maintenance programs	Transcripts were analyzed and coded using qualitative content analysis	Interventions to increase prevalence of breastfeeding among women taking methadone should address identified logistical, educational, and psychological barriers and consider inclusions of women themselves, partners, peers, and clinicians.	Small sample recruited from a single geographic area, which limits generalizability of findings. Women were only interviewed at a single time point.
Dryden, et al., 2009	Maternal methadone use in pregnancy: factors associated with the development of neonatal abstinence syndrome and implications for healthcare resources.	Retrospective Cohort	Univariate Analysis	Inner-city maternity hospital providing dedicated multidisciplinary care to drug-misusing mothers	Four hundred and fifty singleton pregnancies of drug-misusing women prescribed substitute methadone in pregnancy.	Case note review	Higher maternal methadone dose is associated with a higher incidence of NAS. Pregnant drug-misusing women should be encouraged and supported to breastfeed. Their infants are vulnerable and draw heavily on healthcare resources.	Over half the infants given appointments for the outpatient clinic defaulted on two or more occasions, reflective of the complex lifestyle of many drug-misusing parents.

Appendix B – Scoping Review Matrix (Continued)

Author, Date	Study Purpose	Study Design	Level of Evidence	Setting	Sample Description, Size	Data Collection Methods	Results	Limitations
Hodgson, et al., 2012	A Rooming-in Program to Mitigate the Need to Treat for Opiate Withdrawal in the Newborn	Retrospective Chart Review	Descriptive Statistics and logistic regression	BC Women's Hospital, a major prenatal care provider and major tertiary care center in British Columbia for women and newborns	295 Women (and their infants) with a mean maternal age of 27.5; twins were excluded from the analysis.	Analysis of maternal and neonatal data	A significant positive relationship between maternal methadone dose at delivery, "other opiate" use, and breastfeeding and the need to treat the neonate for withdrawal. The maternal methadone dose at delivery is related to the duration of pharmacological treatment of the neonate.	The retrospective study only allows for the consideration of maternal methadone dose only at delivery due to constraints in documented data.
Isemann, et al., 2011	Maternal and neonatal factors impacting response to methadone therapy in infants treated for neonatal abstinence syndrome	Retrospective Review	Univariate Statistics and multivariate logistic regression	Newborn intensive care unit in The University Hospital in Cincinnati, Ohio.	128 infants that received pharmacotherapy for opiate withdrawal	Analysis of maternal and neonatal data	Severity of neonatal abstinence syndrome may be mitigated by titrating methadone to the lowest effective dose during pregnancy and by encouraging breast milk feeds.	Incomplete data collection from medical records (rehospitalized infants due to withdrawal may have been underestimated). The Finnegan abstinence scoring method is a subjective assessment of NAS designed for term infants, and therefore may not be sensitive in detecting NAS in preterm infants.
McQueen, et al., 2011	The Impact of Infant Feeding Method on Neonatal Abstinence Scores of Methadone-Exposed Infants	Retrospective Chart Review	Descriptive Statistics and nonparametric Kruskal-Wallis 1-way analysis of variance	Tertiary care center in Northwestern Ontario	28 term infants that were exposed to methadone in utero and exhibited symptoms of neonatal abstinence syndrome	Extracted data by two independent researchers from both the mother's and infant's chart.	Breastfeeding may offer enhanced benefits for infants who have been exposed to methadone in utero.	Group allocation was self-selected according to feeding type, limiting ability to control for confounding variables. Other confounding variables; maternal education, socioeconomic status and culture were not evaluated as this data was not in hospital records. Small group sizes and instrument bias.

Appendix B – Scoping Review Matrix (Continued)

Author, Date	Study Purpose	Study Design	Level of Evidence	Setting	Sample Description, Size	Data Collection Methods	Results	Limitations
Pritham, 2013	Breastfeeding promotion for Management of Neonatal Abstinence Syndrome	Systematic Review	A literature review regarding the association between breastfeeding and NAS severity, need for pharmacologic treatment, and length of hospital stays.	Various hospitals and municipalities	Not specified	PubMed, CINAHL, and Medline were searched for articles published between January 1990 and April 2013 using the terms opioid dependency in pregnancy, neonatal abstinence syndrome, methadone, buprenorphine, neonatal length of stay, breastfeeding, methadone in breast milk, buprenorphine in breast milk, swaddling, and rooming-in.	Understanding the benefits of breastfeeding for opioid-dependent pregnant women and their neonates will enable clinicians to safely recommend breastfeeding for long-term health of these high-risk women and their infants.	Not specified
Wachman, et al., 2010	Breastfeeding Rates Among Mothers of Infants with Neonatal Abstinence Syndrome	Retrospective Chart Review	Descriptive Statistics	Boston Medical Center, MA	276 infants with NAS and their mothers	Analysis of maternal and neonatal data	Breastfeeding rates among opioid-dependent women were low, with three-quarters of those eligible electing not to breastfeed. Of the minority of women who did choose to breastfeed, more than half stopped within 1 week.	Retrospective chart review; definite reasons as to why these women chose not to breastfeed and why they stopped breastfeeding were unable to be fully explored. Smoking status of mothers was not obtained; slight variations in hospital guidelines related to NAS and breastfeeding, and small number of women taking buprenorphine.
Welle-Strand, et al., 2013	Breastfeeding reduces the need for withdrawal treatment in opioid-exposed infants	Cohort Design, three study parts	Descriptive Statistics	Various hospitals and municipalities	National cohort of 124 women treated with either methadone or buprenorphine during pregnancy, and their neonates born between 1999 and 2009 was evaluated in three study parts	Finnegan scoring tool, questionnaires, and medical information	Breastfed neonates exposed to OMT medication prenatally, and methadone-exposed newborns have lower incidence of NAS and require shorter pharmacotherapy for NAS than infants who are not breastfed.	The retrospective study data may be less accurate due to relying on subject recall. The infants were born in 18 different hospitals, with varying experiences and NAS assessment. The questionnaire didn't cover extent of breastfeeding.

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Factors Influencing Healthcare Providers' Behaviors in the Care of Infants with Neonatal Abstinence Syndrome (NAS): An Integrative Review

Abstract

Due to a significant increase in the number of infants diagnosed with neonatal abstinence syndrome and the lengthy hospitalization often required for their pharmacologic treatment, a comprehensive understanding of the factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions for infants with neonatal abstinence syndrome is needed. The Whittemore and Knafl methodology guided an integrative review of literature on the current knowledge of the individual and contextual factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions that decrease the length of stay for infants with neonatal abstinence syndrome through the lens of the Theoretical Domains Framework. Results of this review may provide knowledge to inform future interventions and assist in the development and implementation of best practice standards, clinical practice guidelines, and protocols to improve the care of this vulnerable and rapidly-growing patient population: the neonatal abstinence syndrome maternal-infant dyad.

Keywords

Neonatal abstinence syndrome; neonatal withdrawal; theoretical domains framework; nonpharmacological interventions; nursing interventions; complementary therapy; length of stay

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Review

Factors influencing healthcare providers' behaviors in the care of infants with neonatal abstinence syndrome (NAS): An integrative review

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ABSTRACT

Due to a significant increase in the number of infants diagnosed with neonatal abstinence syndrome and the lengthy hospitalization often required for their pharmacologic treatment, a comprehensive understanding of the factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions for infants with neonatal abstinence syndrome is needed. The Whittemore and Knafl methodology guided an integrative review of literature on the current knowledge of the individual and contextual factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions that decrease the length of stay for infants with neonatal abstinence syndrome through the lens of the Theoretical Domains Framework. Results of this review may provide knowledge to inform future interventions and assist in the development and implementation of best practice standards, clinical practice guidelines, and protocols to improve the care of this vulnerable and rapidly-growing patient population: the neonatal abstinence syndrome maternal-infant dyad.

The number of expectant mothers using opiates during pregnancy has increased alarmingly over the past decade, rising nearly five-fold from 2000 to 2009 (Patrick et al., 2012). Among neonates with in-utero exposure to opioids, an estimated 60–90% experience drug withdrawal, a condition defined as neonatal abstinence syndrome (NAS) (Ebner et al., 2007). NAS is characterized by a wide array of bothersome symptoms and complications, including increased irritability, hypertonia, tremors, feeding intolerance, emesis, watery stools, seizures, and respiratory distress, and often results in prolonged hospitalization and extensive pharmacological therapy (American Academy of Pediatrics Committee on Drugs, 1998). According to the National Institute on Drug Abuse, 21,732 infants were born with NAS in the United States (US) in 2012, equivalent to one infant suffering from opioid withdrawal born every 25 min (Patrick et al., 2012).

In a retrospective analysis, Patrick et al. (2015) determined that from 2009 to 2012 the aggregate hospital costs attributed to the care of infants with NAS increased from $732 million to $1.5 billion ($p < .001$), with 81% allocated to state Medicaid programs. Their analysis also revealed that the national incidence of NAS increased from 3.4 to 5.8 per 1000 hospital births during the same time period (Patrick et al., 2015). Based on the 2012 estimates, Patrick et al. (2015) determined that decreasing infants' lengths of stay by 2 days could result in a nationwide savings of an estimated $170 million in hospital charges per year.

In addition to the high healthcare cost of NAS, mothers and infants encounter negative outcomes as a result of NAS. Hospitalization for NAS most commonly results in an admission to a Neonatal Intensive Care Unit (NICU), disrupting maternal and infant bonding (Patrick et al., 2015). Mitigating the clinical complications of NAS may improve the outcomes that are more challenging to measure, including maternal attachment (Eapen et al., 2014). The significant healthcare costs associated with NAS and the negative impact long hospital stays have on the maternal-infant bond warrant research dedicated to identifying interventions aimed at reducing the infant's length of stay (LOS) while maintaining standards of care.

Extensive research has been conducted on pharmacologic treatment for infants with NAS. Specifically, researchers agree that opiates (oral morphine, methadone) should be first-line treatment (American Academy of Pediatrics Committee on Drugs, 1998). However, the assessment and care management of infants with NAS varies widely among hospitals in the US, and existing assessment and management protocols have been based on minimal empirical data (Bagley et al., 2014). In a recent survey of accredited US neonatology fellowship programs, only 55% had implemented a written NAS protocol, and only 69% used a published abstinence scoring system to determine the severity of withdrawal, which in turn informs the treatments provided (Sarkar and Donn, 2005). The American Academy of Pediatrics (AAP) Committee on Drugs recommends the establishment of a protocol guiding the assessment and management of infants diagnosed with NAS or those at high risk for withdrawal (Hudak and Tan, 2012).

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Although nonpharmacological nursing care is critical in decreasing withdrawal symptoms in infants with NAS, minimal research identifying developmentally appropriate nursing interventions exists. Murphy-Oikonen et al. (2010) advise that nurses providing care for infants with NAS receive specialized training that addresses all facets of nursing care, including providing detailed information on addiction and drug use during pregnancy. A central goal of this training is to increase nursing knowledge of NAS and empathy for mothers of infants with NAS, as well as improve nursing morale and interdisciplinary collaboration when caring for challenging cases that require extensive resources (Murphy-Oikonen et al., 2010). According to Velez and Jansson (2008), nonpharmacologic nursing care consists of the careful assessment of mother and infant, provision of caregiving interventions, and the adaptability of environmental and social interactions that support neurodevelopment and physiological stability. Additional examples of nonpharmacologic nursing interventions include swaddling, providing quiet and low-stimulation environments, rooming-in, skin-to-skin holding, breastfeeding (unless contraindicated), and infant positioning (Ryan et al., 2018). Nonpharmacologic nursing care is not intended to be a substitute for pharmacologic treatment; rather, it should be considered the standard of care for substance-exposed infants (Velez and Jansson, 2008). Velez and Jansson (2008) posit that an essential component of nonpharmacologic care is nurses educating mothers on how to properly comfort and care for their infant with NAS.

Due to a significant increase in the number of infants diagnosed with NAS and the lengthy hospitalization often required for their pharmacologic treatment, a comprehensive understanding of the factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions for infants with NAS is needed. The Whittemore and Knafl (2005) methodology guided an integrative review of literature on the current knowledge of the individual and contextual factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions that decrease the LOS for infants with NAS through the lens of the Theoretical Domains Framework (TDF). Results of this review may provide knowledge to inform future interventions and assist in the development and implementation of best practice standards, clinical practice guidelines (CPGs), and protocols to improve the care of this vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

1. Theoretical framework

The Theoretical Domains Framework (TDF) provides a structure for assessing and evaluating the factors that affect the behavior of healthcare providers and the implementation of evidence-based practice (Cane, O'Connor and Michie, 2012). The TDF was developed to aid in the simplification and application of various behavior change theories for interdisciplinary use (Cane et al., 2012). The developers of the TDF identified 33 theories and 128 key theoretical constructs associated with *behavior change* and synthesized them into one framework that can be used to assess implementation and other behavioral issues and inform the development of interventions in clinical practice (Cane et al., 2012). The TDF consists of 14 domains of theoretical constructs: 'Knowledge,' 'Skills,' 'Social/Professional Role and Identity,' 'Beliefs about Capabilities,' 'Optimism,' 'Beliefs about Consequences,' 'Reinforcement,' 'Intentions,' 'Goals,' 'Memory, Attention, and Decision Processes,' 'Environmental Context and Resources,' 'Social influences,' 'Emotion,' and 'Behavioral Regulation' (Cane et al., 2012).

The TDF has been used previously to frame a systematic review of interventions aimed at improving the implementation of CPGs in post-fracture care management (Little et al., 2015). Little et al. (2015) explored the clinician behavioral factors targeted by the interventions in the systematic review and how they related to the size of the effect on rates of bone mineral density scanning and osteoporosis treatment. In addition, in a 2014 study, Tavender et al. (2014) examined the factors perceived to influence the uptake of four key evidence-based practices for managing mild traumatic brain injury by using the TDF as the guiding framework. This study was the first step in developing and identifying a targeted, theory- and evidence-informed intervention to improve the management of mild traumatic brain injury in Australian emergency departments (Tavender et al., 2014). The TDF, therefore, is an appropriate theory-based framework to aid in the identification of behavioral factors to target when implementing evidence-based interventions.

Table 1
Available databases on the EBSCOhost platform.

EBSCOhost databases
CINAHL Complete; Academic Search Premier; Agricola; Alt HealthWatch; Newswires; Applied Science & Technology Full Text (H.W. Wilson); CINAHL Plus with Full Text; Computer Source; Criminal Justice Abstracts with Full Text; eBook Collection (EBSCOhost); Education Full Text (H.W. Wilson); ERIC; European Views of the Americas: 1493 to 1750; Fuente Académica; Funk & Wagnalls New World Encyclopedia; GreenFILE; Health Source - Consumer Edition; Health Source: Nursing/Academic Edition; History Reference Center; Library Literature & Information Science Index (H.W. Wilson); Library, Information Science & Technology Abstracts; MAS Ultra - School Edition; MasterFILE Premier; MEDLINE; Middle Search Plus; Military & Government Collection; Newspaper Source Plus; Primary Search; Professional Development Collection; PsycARTICLES; Psychology and Behavioral Sciences Collection; PsycINFO; Regional Business News; Religion and Philosophy Collection; Science Reference Center; Teacher Reference Center; TOPICsearch; Vocational and Career Collection; Web News; AHFS Consumer Medication Information; American Doctoral Dissertations, 1933–1955; eBook Academic Collection (EBSCOhost); Consumer Health Complete - EBSCOhost;

2. Methods

Whittemore and Knafl (2005) modified Cooper's framework (Cooper, 1998) to address the challenges of integrating various data sources inherent to conducting integrative reviews. They also identified the following stages to increase reliability of findings and methodological rigor: *Problem Identification, Literature Search, Data Evaluation, Data Analysis, and Presentation* (Whittemore and Knafl, 2005). With these stages in mind, the literature search began by consulting a medical reference librarian at an academic medical center. The following electronic databases were determined to be the most appropriate for this integrative review: Scopus, PubMed, and EBSCOhost (see Table 1). Each database was searched using the following key terms: "*Neonatal Abstinence Syndrome*" AND "*complementary therapy*" OR *"non-pharmacological interventions"* OR *"non-pharmacological interventions"* OR *"nursing interventions"* AND *"length of stay."*

During the first search of the electronic databases, 277 articles were retrieved. After citations were reviewed, 93 articles were determined to be duplicates and were therefore removed. The abstracts of the remaining 184 articles were examined for relevance based on the inclusion criteria: English language, publication in peer review journals, and studies with human subjects. The reference lists of selected articles were also examined for primary sources and additional pertinent articles. Research articles specific to healthcare provider-based individual and contextual factors that decrease the LOS for infants with NAS were included. Articles were excluded if they contained findings that were greater than 10 years old, were not specific to the inpatient NAS population, were not conducted within the US or Canada, did not address provider nonpharmacological interventions as a variable, or did not include the LOS as an outcome measure (n = 166). Of the remaining 18 full-text articles, 12 studies were excluded for being reviews (n = 8), surveys identifying variation in protocols (n = 2), specific to one assessment tool (n = 1), and a clinical report (n = 1). Six studies met the inclusion criteria for the study sample, and one study was identified through a review of references for a total of 7 studies (see Appendix A). An integrative review matrix (Appendix B) was created to organize the selected articles by author, date, study purpose, study design, setting, sample description, size, data collection methods, and results.

Table 2
Literature/TDF domains/influential factors matrix.

Author, Date	Study Purpose	TDF Domains	Influential Factors
Asti et al. (2015)	Multidisciplinary Task Force created to implement a standardized treatment protocol, discuss strengths and weaknesses of the current medical and nursing management of NAS, and improve communication among staff. **Sample:** 92 infants; Nationwide Children's Hospital in Columbus, Ohio.	***Knowledge, Skills, & Social/Professional Role & Identity***	• Development of educational program for nursing staff regarding the use of the Finnegan scoring tool. • Use of instructional video, "train the trainer" approach, and super-users. • Multidisciplinary task force improved education, communication, and dissemination of treatment information.
Casper et al. (2014)	A review and analysis of the literature and interviews with neonatal experts guided the development of a nursing CPG for infants with NAS in a level IV NICU. **Sample:** 56-bed level IV NICU, employing more than 170 RNs; Cincinnati Children's Hospital Medical Center, Ohio.	***Social/Professional Role & Identity***	• Education and interdisciplinary approach was an integral component in revising CPG guidelines and improving neonatal outcomes.
Grossman et al. (2017)	An initiative to improve the quality of care of infants with NAS. **Sample:** 287 infants; Yale New Haven Children's Hospital.	***Skills, Social/Professional Role & Identity***	• Identified four key factors instrumental in decreasing LOS: nonpharmacologic interventions, simplified assessment of infants, decreased use of morphine, and effective communication between care units. • Formed multidisciplinary team and included parents as integral part of care team.
Murphy-Oikonen et al. (2012)	To evaluate the effectiveness of a CPG on increasing identification of neonates with NAS symptoms based on a toxicology screening protocol, decreasing the mean NAS score and average LOS. **Sample:** 90 Neonates; Regional Hospital in a mid-size Canadian city.	***Knowledge***	• Identified three significant results post-implementation of CPGs: increased identification of newborns with NAS, decreased NAS severity using the Finnegan scoring tool, and decreased LOS.
Nelson (2016)	The purpose of the focused ethnography was to describe the culture of care and nonpharmacologic nursing interventions performed by NICU nurses for infants with NAS. **Sample:** 12 full-time nurses; a 44-bed NICU at a Children's Hospital in the southeastern US.	***Social/Professional Role & Identity***	• Six themes were identified in the culture of care for infants with NAS: learn the infant, core team relationships, role satisfaction, grief, making a difference, and education and care of the mother.
Patrick et al. (2016)	Designed and implemented a multicenter quality improvement collaborative for infants with NAS. The objective was to determine if the collaborative was effective in standardizing hospital policies and improving patient outcomes. **Sample:** 3458 infants; 199 participating centers in the multicenter, multistate quality improvement collaborative.	***Knowledge***	• LOS decreased post-implementation of evidence-based potentially better practices, which were supported by interactive webinars, real-time feedback of outcomes, and sharing improvement practices through electronic forums.
Saunders et al. (2014)	An evidence-based, multidisciplinary NAS protocol was developed using a step-wise continuous quality improvement approach with the goal of standardizing care procedures for infants with NAS. **Sample:** 413 infants; 60-bed, level III NICU at East Tennessee Children's Hospital.	***Knowledge, Skills, & Social/Professional Role & Identity***	• LOS reduced post-implementation of pharmacologic weaning protocol. • Refined NAS assessment skills, standardized clinical care protocols, including communication with parents.

The primary goal of the data analysis stage is to provide a "thorough and unbiased interpretation of primary sources, along with an innovative synthesis of the evidence" (Whittemore and Knafl, 2005). In this integrative review, the primary sources were first divided into subgroups according to study design and then analyzed for content. Next, data was extracted and coded according to specific themes informed by constructs of the TDF, allowing for the comparison and contrasting of specific issues, variables, or characteristics (Whittemore and Knafl, 2005). Finally, a synthesis of findings was developed to identify key elements, relationships, and frequency of phenomena, and to address conflicting findings.

This integrative review, through the lens of the TDF, identified specific domains that have been addressed in each of the selected studies. A majority of the studies addressed the following key domains from the TDF; *Knowledge* (n = 4), *Skills* (n = 3), and *Social/Professional Role and Identity* (n = 4), (see Table 2). The intent of the data presentation stage is to synthesize the depth and breadth of the subject matter and contribute to a new understanding of the phenomenon of interest, as well as to identify implications for practice, research, and policy initiatives (Whittemore and Knafl, 2005). The conclusions of this integrative review have been reported through text, tables, and matrices.

3. Results

The studies included in this sample (n = 7) were conducted in hospitals; five studies utilized a quality improvement design (Asti et al., 2015; Casper and Arbour, 2014; Grossman et al., 2017; Patrick et al., 2016; Saunders et al., 2014), one study utilized a retrospective cohort design (Murphy-Oikonen et al., 2010), and one study utilized a focused ethnography design (Nelson, 2016). All studies were evaluated for quality and included in this integrative review due to their data relevance and to the value of information each study provided. Data for the selected studies included historical maternal and neonatal medical record information, including LOS, length of treatment (LOT), interviews, nursing assessments, and withdrawal indexes from NAS scoring tools. A majority of the articles (n = 6) addressed the effects of standardized protocols, CPGs, and provider-based management and treatment of NAS on the severity of NAS and LOS. In addition, Asti et al. (2015) incorporated *The Model for Improvement Methodology* in their quality improvement project, Nelson (2016) used *Roper and Shapira's Framework* for analysis in her focused ethnography, and none of the selected studies incorporated the TDF to inform the study design or implement the intervention(s).

Knowledge, *Skills*, and *Social/Professional Role and Identity* were identified as the most influential domains relevant to modifying healthcare providers' behaviors regarding the implementation of non-pharmacological interventions specifically aimed at decreasing the LOS for infants with NAS. The primary themes identified within these domains included knowledge of NAS and AAP recommendations regarding the management of NAS, nursing competence (assessment skills and effective utilization of the Finnegan scoring tool), ability to develop

interpersonal relationships with parents within professional boundaries, ability to establish role and collaboratively work within a multidisciplinary team, and ability to lead in the management and care of infants with NAS. Table 2 identifies the influential factors and TDF domains addressed by each article.

3.1. TDF Domain: knowledge

Modifying the behavior of healthcare providers is critical to achieving the objectives of evidence-based medicine and to ensuring that research findings are translated into clinical practice to improve patient outcomes (Little et al., 2015). The *Knowledge* domain of the TDF includes the following constructs: knowledge, knowledge about condition/scientific rationale, schemas + mindsets + illness representations, and procedural knowledge (Atkins et al., 2017). The following studies addressed the constructs of the TDF *Knowledge* domain that align with the influential factors determined to decrease the LOS for infants with NAS.

In several of the studies, researchers found that the consistent use of standardized protocols for the treatment of, supported by educational interventions for staff, had a significant impact on decreasing the infants' LOS and length of pharmacologic treatment and improving patient outcomes (Asti et al., 2015; Murphy-Oikonen et al., 2012; Patrick et al., 2016; Saunders et al., 2014). In two separate quality improvement projects, Saunders et al. (2014) and Asti et al. (2015) determined the most influential factors on LOS for infants with NAS were the development of formal educational programs for nursing staff regarding the proper use of the Finnegan scoring system and the implementation of a standardized treatment protocols. After implementing a stringent pharmacologic weaning protocol and standardizing the Finnegan scoring tool, Asti et al. (2015) reported a reduction in LOS from 36 days to 18 days for infants with NAS. Saunders et al. (2014) sought to evaluate the effectiveness of an evidence-based, multidisciplinary continuous quality improvement approach and found the LOS was reduced by 10.35 days ($p = .002$) after the implementation of a pharmacologic weaning protocol as the foundational first step of the continuous quality improvement project.

In another quality improvement study, Patrick et al. (2016) developed a multicenter, multistate quality improvement collaborative followed by a retrospective analysis to determine if the collaborative was effective in standardizing hospital policies and improving patient outcomes. The development of evidence-based, potentially better practices was supported by interactive webinars, real-time feedback of outcomes, and sharing improvement practices through electronic forums (Patrick et al., 2016). These educational, collaborative support strategies were effective in standardizing hospital care and improving infant outcomes (Patrick et al., 2016). The researchers found a decrease in the median LOS from 21 days (14–33 days) to 19 days (15–28 days; $p = .002$) and LOT from 16 days (10–27 days) to 15 days (10–24 days; $p = .02$) post implementation of potentially better practices (Patrick et al., 2016).

Comparable to the other studies by Asti et al. (2015), Saunders et al. (2014), and Patrick et al. (2016), Murphy-Oikonen et al. (2012) identified two significant results post-implementation of CPGs: decreased NAS severity using the Finnegan scoring tool and decreased LOS. CPGs provide clinicians with the knowledge of explicit recommendations that assist in the comprehensive care of the maternal-infant dyad (Murphy-Oikonen et al., 2012). Prior to the implementation of CPGs there was wide variation among clinicians in treating infants with NAS. The use of nonpharmacological nursing interventions was incorporated in the CPGs as a first step in the clinical management of infants with NAS.

3.2. TDF domain: skills

The *Skills* domain of the TDF includes the following constructs: skills, competence/ability/skill, assessment, practice/skills development, interpersonal skills, and coping strategies (Atkins et al., 2017). The following studies addressed the constructs of the TDF *Skills* domain that most relate to factors determined to decrease the LOS for infants with NAS.

The AAP recommends the use of a standardized tool such as the Neonatal Abstinence Scoring System (Finnegan) for evaluation of NAS (Hudak and Tan, 2012). The AAP also recommends the incorporation of an inter-observer reliability educational program for the Finnegan Scoring System to increase clinician competence and overall quality improvement (Bagley et al., 2014). The utilization of standardized assessment tools aids clinicians in determining the severity of neonatal withdrawal, thereby providing data to determine therapeutic pharmacological decisions.

Several of the studies found that specific training for nursing staff regarding the use of the Finnegan scoring tool, refinement of assessment skills, and inclusion of nonpharmacological interventions and parent engagement decreased the infant's LOS and improved communication among care providers and parents (Asti et al., 2015; Grossman et al., 2017; Saunders et al., 2014). For example, in a quality improvement project, Asti et al. (2015) determined that excessive variability in the Finnegan scores documented by the neonatal nurses complicated the treatment and management of infants with NAS. To mitigate the variability, they sought the assistance of a nursing expert in the management of NAS patients and the application of the Finnegan scoring tool (Asti et al., 2015). Through the use of an instructional video and a "train the trainer" approach, "super users" were taught how to assign Finnegan scores based on the signs and symptoms of NAS (Asti et al., 2015). The specific aim of this study was to decrease the LOS from 31 to 24 days; however, the intervention resulted in an even greater decrease in the LOS to 18 days (Asti et al., 2015). The significant decrease in LOS was attributed to the retraining of nursing staff on the utilization of the Finnegan scoring tool (Asti et al., 2015).

Grossman et al. (2017) identified four key factors instrumental in decreasing the average LOS for infants with NAS: nonpharmacologic interventions, simplified assessment of infants, decreased use of morphine, and effective communication between care units. The researchers standardized four nonpharmacologic interventions: 1) Infants were placed in a low-stimulation environment, 2) Staff engaged parents continuously in the care of their infants, 3) Nurses were trained to view nonpharmacologic interventions as equivalent to medications, and 4) The care team encouraged human milk feedings for infants for whom there were no contraindications (HIV, illicit drug use) (Grossman et al., 2017). Contrary to AAP recommendations, Grossman et al. (2017) advised the care team to discontinue the use of the Finnegan scoring tool and develop their own assessment criteria based on the infant's ability to eat, sleep, and to be consoled. By modifying how nurses assessed and treated infants with NAS, the infants' average LOS was reduced from 22.4 to 5.9 days, far below the national average of 23 days for infants requiring pharmacological treatment (Grossman et al., 2017).

Similarly, Saunders et al. (2014) developed and implemented an evidence-based, multidisciplinary NAS protocol using a stepwise continuous quality improvement approach with the objective of standardizing care procedures for the NAS patient population. As part of this protocol, the multidisciplinary team of caregivers refined their NAS assessment skills and focused primarily on: a) standardizing clinical care protocols, including the approach for communicating with parents and the delivery of care to infants; b) ensuring the consistency of clinical staff's use of the Finnegan assessment tool; c) modifying care interventions and the care environment to assist infants with autonomic regulation and sensory integration; and d) implementing measures to optimize feeding tolerance and nutritional status (Saunders et al., 2014). The development of standardized, multidisciplinary clinical care protocols clarified the treatment plan and objectives among all members of the multidisciplinary care team, including the parents, and resulted in a reduction of 10.35 days ($p = .002$) in the infant's LOS (Saunders et al., 2014). An unanticipated positive finding of the Saunders et al. (2014) study was the improvement of the quality of

communication between care providers and parents.

3.3. TDF domain: Social/Professional Role and Identity

The *Social/Professional Role and Identity* domain of the TDF includes the following constructs: identity, professional identity/boundaries, role, group/social identity, social/group norms, and alienation/organizational commitment (Atkins et al., 2017). The following studies addressed the constructs of the TDF *Social/Professional Role and Identity* domain that align with factors identified as decreasing the LOS for infants with NAS.

In a majority of the selected studies, a multidisciplinary treatment approach led to an overall improved outcome for opioid weaning and symptom management for infants with NAS. A study by Saunders et al. (2014) included a multidisciplinary NAS task force including: hospital and community stakeholders, representatives from medicine (neonatology, perinatology, pediatric, and rehabilitation medicine), nursing, pharmacy, social work, hospital administrative staff, volunteers (cuddlers), developmental follow-up therapists, rehabilitation therapists (physical therapy, occupational therapy, and speech-language pathology), child life specialists, and child protective service providers who facilitated community support programs for this vulnerable maternal-infant dyad. The NAS task force facilitated collaborative problem solving, the development of educational programs, new community-based services for infants with NAS and their families, and the redesign of systems targeted towards the improvement of outcomes in existing community services (Saunders et al., 2014). Similarly, Asti et al. (2015) also created a multidisciplinary NAS taskforce that sought to develop and implement a standardized treatment protocol, discuss the strengths and weaknesses of the existing medical and nursing management, and improve communication among staff. Asti et al. (2015) viewed the taskforce as an essential intervention as it facilitated the improvement of education, communication, and the dissemination of critical treatment information among clinical staff.

Like Saunders et al. (2014) and Asti et al. (2015), Grossman et al. (2017) formed a multidisciplinary team that included attending physicians, residents, staff nurses, nursing leadership, child life specialists, and social workers to develop interventions aimed at improving the care and reducing the LOS for infants with NAS. Parents were included as an integral part of the treatment team; therefore, nurses and physicians supported and educated parents on caring for their infants (Grossman et al., 2017). This approach changed the dynamic from one where parents were merely allowed to visit their infants to one in which they were empowered to be the most important part of their infant's care (Grossman et al., 2017). Nelson (2016) presented a similar finding: educating and caring for the mother in a non-judgmental way was essential to mitigate the potential barrier between the healthcare provider and mother to enhance maternal self-efficacy in caring for her infant with NAS.

Similar to Grossman et al. (2017) and Nelson (2016), Casper and Arbour (2014) posited that this complex maternal-infant dyad required parental and clinician education and a multidisciplinary approach to improve maternal and neonatal outcomes. They reviewed and implemented evidence-based, nurse-driven interventions in the revision of their CPGs (Casper and Arbour, 2014). To ensure the revised CPGs addressed the needs of key stakeholders, infants, and their families, multidisciplinary collaborative discussions were scheduled periodically (Casper and Arbour, 2014). Casper and Arbour (2014) found the implementation of CPGs provided nurses with clear direction when caring for their patients resulting in a decrease in the LOS and improved outcomes for infants with NAS.

4. Discussion

The purpose of this integrative review was to explore, critique, and synthesize the current knowledge of the individual and contextual factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions that decrease the LOS for infants with NAS. The TDF provided a structure for identifying the domains and constructs that align with the influential factors determined to decrease the LOS for infants with NAS.

The primary finding of this integrative review is that the development and implementation of evidence-based, standardized CPGs improves the overall health and developmental outcomes of the NAS maternal-infant dyad as well as reduces the LOT and LOS for the infant (Asti et al., 2015; Casper and Arbour, 2014; Grossman et al., 2017; Murphy-Oikonen et al., 2012; Patrick et al., 2016; Saunders et al., 2014). Several of the studies in this review addressed the constructs of the TDF *Knowledge* domain by demonstrating that the implementation of CPGs and educational training programs for clinicians in the assessment, utilization of scoring tools, treatment, and management of infants with NAS aids in the translation of evidence to clinical practice and improves maternal-infant outcomes (Asti et al., 2015; Murphy-Oikonen et al., 2012; Patrick et al., 2016; Saunders et al., 2014). In addition, the implementation of CPGs clarified the treatment plan and objectives among all members of the multidisciplinary care team, including the parents (Saunders et al., 2014).

Another key finding of this review is that the consistent, skillful use of a standardized withdrawal scoring tool substantially reduces the LOT and LOS for infants with NAS. Several of the studies in this review addressed the constructs of the TDF *Skills* domain by showing that the inclusion of nonpharmacologic nursing interventions, refinement of NAS assessment skills, and accurate scoring of NAS withdrawal symptoms significantly reduced the severity of withdrawal, LOT, and LOS and improved maternal and infant outcomes (Asti et al., 2015; Grossman et al., 2017; Saunders et al., 2014). This is important because inaccurate assessments and utilization of withdrawal scoring tools can lead to unnecessary pharmacologic treatment, which will prolong drug exposure and the duration of hospitalization to the possible detriment of maternal-infant bonding (Hudak and Tan, 2012).

Maguire (2014) suggests that nurses who regularly care for infants with NAS refine their assessment skills and establish high levels of inter-rater reliability using the withdrawal scoring tool, as well as gain expertise in establishing relationships with parents with very specific needs. In addition, Velez and Jansson (2008) posit that the implementation of comprehensive assessments and interventions of the mother in treatment, her infant, and the maternal-infant dyad can improve early maternal nurturing interactions, a critical component of early infant development, particularly in this vulnerable population.

An additional finding of this review is that the development of NAS multidisciplinary teams substantially improves education, communication, and the dissemination of critical treatment information among team members as well as ensures that each team member has the opportunity to present concerns that can be addressed in a collaborative, problem-solving manner (Asti et al., 2015; Casper and Arbour, 2014; Grossman et al., 2017; Saunders et al., 2014). Studies that addressed the constructs of the TDF *Social/Professional Role and Identity* domain indicated a multidisciplinary approach to caring for infants with NAS and their families is an effective strategy to address the healthcare needs of this vulnerable maternal-infant dyad (Saunders et al., 2014). In addition, the healthcare provider has a critical role in the evaluation, treatment, and management of care for this vulnerable and complex maternal-infant dyad; however, the most integral part of a successful treatment plan for the infant is the inclusion of the parents in their infant's care (Grossman et al., 2017; Maguire, 2014; Nelson, 2016). NAS is a rapidly growing, complex health concern with infants, families, and healthcare providers all having individual needs that must be thoroughly addressed to ensure the best outcomes for this vulnerable maternal-infant dyad (Saunders et al., 2014).

5. Limitations

This integrative review focused on the current knowledge of the individual and contextual factors influencing healthcare providers' behaviors in implementing nonpharmacological interventions that decrease the LOS for infants with NAS; therefore, articles that were greater than 10 years old were excluded from this review. In addition, studies that were conducted outside of the US and Canada were excluded due to concerns of generalizability. Although great care was taken to ensure the key terms used would identify the most appropriate studies and publications, it is possible alternate terms could produce findings not included in this review.

One of the studies included in this review had a small sample size, which also may potentially limit generalizability. In addition, one of the studies had limited data or differences in maternal antenatal drug use, which can affect the NAS LOT and LOS (Patrick et al., 2016). Similarly, the retrospective design study was unable to identify neonates who were only exposed to methadone (Murphy-Oikonen et al., 2012). The focused ethnography is a qualitative study, and due to its contextual nature is considered less generalizable; however, due to the rich, thick descriptions of the findings, the data is easily transferable to similar contexts (Nelson, 2016).

Finally, the utilization of the TDF in this context provided challenges because not all domains are necessarily mutually exclusive, with some sharing certain constructs (Little et al., 2015). Given the inferential nature of coding the constructs and themes, there were instances when identifying a targeted domain proved to be difficult (Little et al., 2015). This challenge has been noted in other studies with regard to the lack of clear boundaries within the TDF (Little et al., 2015).

6. Literature gaps

Despite the fact that nonpharmacological nursing care is critical in decreasing withdrawal symptoms in infants with NAS, minimal research identifying developmentally appropriate nursing interventions exists. Further, current NAS assessment and management protocols are based on limited empirical data and more research is needed to identify best practices in the standard of care for the NAS maternal-infant dyad (Bagley et al., 2014). More studies are needed to explore and quantify the effect of parental involvement in the care of their infant with NAS (Grossman et al., 2017). Additionally, further research is needed to understand the long-term developmental implications for infants with early drug exposure (Asti et al., 2015). Finally, this review identifies the factors that have been shown to have the most influence on healthcare providers' behaviors in implementing nonpharmacological interventions and the TDF domains that most closely align with these factors. Additional studies are needed to investigate other domains that may be targeted for future implementation of interventions.

7. Conclusion

Translating the AAP recommendations to practice is important because unnecessary pharmacologic treatment will prolong drug exposure and the LOS to the possible detriment of maternal-infant bonding (Asti et al., 2015; Hudak and Tan, 2012). The significant increase in infants diagnosed with NAS has led to a critical need for the utilization of a standardized, objective, and validated assessment tool to guide the treatment of NAS. Proactive educational strategies targeted to multidisciplinary healthcare providers may be necessary to successfully implement evidence-based recommendations and to ensure changes in clinical practice regarding the management of NAS is consistent with published guidelines (Ambalavanan et al., 2004). The significant healthcare costs associated with NAS and the negative impact long hospital stays have on the maternal-infant bond warrant research dedicated to identifying interventions aimed at reducing the infant's LOS.

Conflicts of interest

None.

Role of funding source

No external funding.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jnn.2019.07.006.

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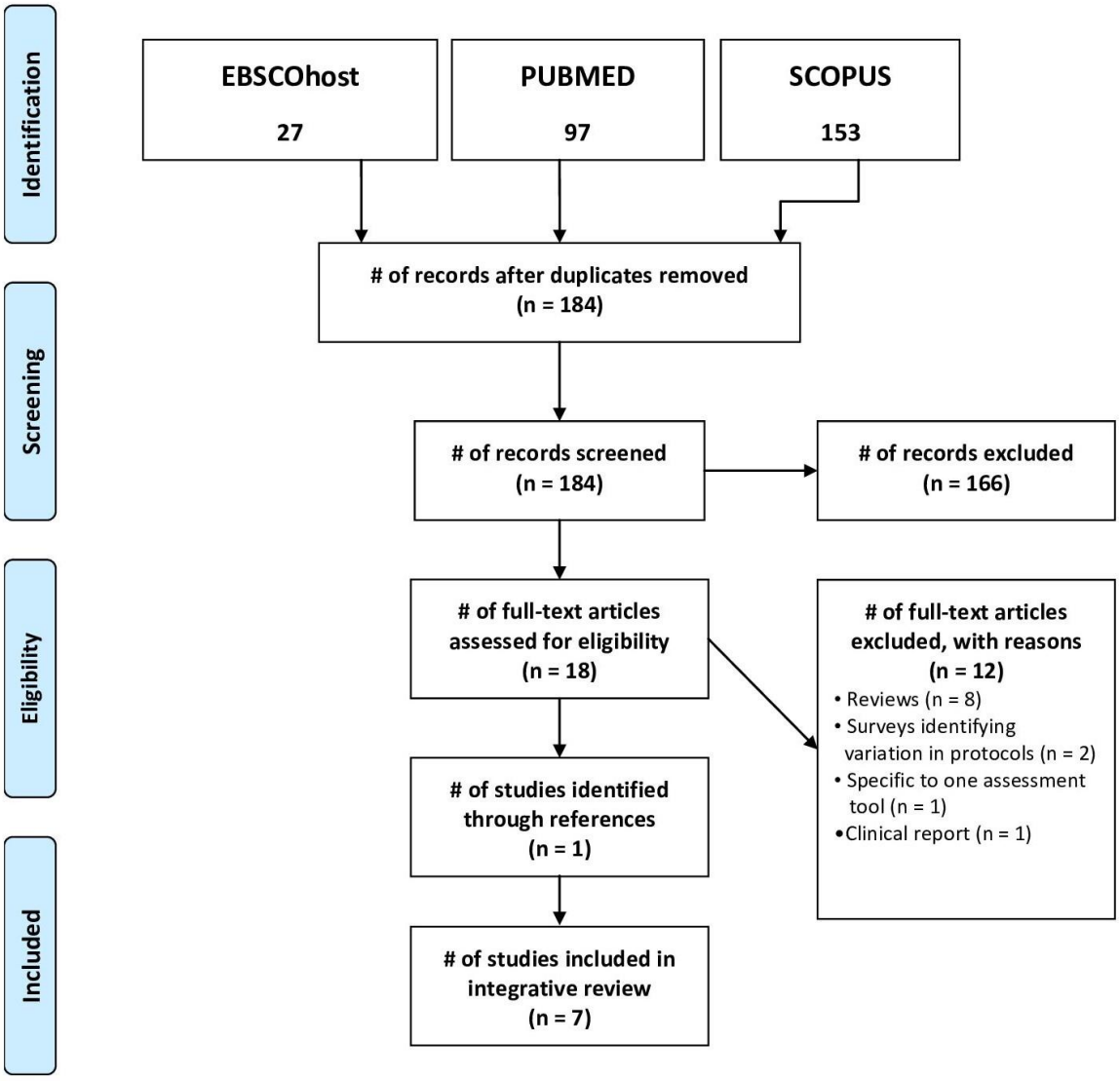
Appendix A – PRISMA Diagram

Search Terms: *neonatal abstinence syndrome, complementary therapy, nonpharmacological interventions or non-pharmacological interventions, nursing interventions, and length of stay*

Factors Influencing Healthcare Providers' Behaviors in the Care of Infants with Neonatal Abstinence Syndrome (NAS): An Integrative Review



Appendix B – Literature Review Matrix

Author, Date	Study Purpose	Study Design	Setting	Sample Description, Size	Data Collection Methods	Results
Asti et al, 2015	A multidisciplinary NAS task force was created to implement a standardized treatment protocol, discuss the strengths and weaknesses of the current medical and nursing management, and improve communication among staff.	Quality Improvement Project	Nationwide Children's Hospital in Columbus, Ohio	92 infants	Neonatal medical record data	Reliable monitoring of symptoms and the administration of a standardized morphine protocol effectively reduced LOS from 36 days to 18 days. One of the most effective interventions that impacted the LOS was the development of a staff NAS education program.
Casper et al, 2014	A thorough review and analysis of the literature and interviews with neonatal experts guided the development of a nursing CGP for infants with NAS in a level IV NICU.	Quality Improvement Project	A Level IV NICU at Cincinnati Children's Hospital Medical Center, Ohio	56-bed level IV NICU, employing more than 170 RNs with staff experience ranging from new graduate to over 30 years.	The CPG-update initiative included an evaluation of the literature regarding nurse-driven interventions to support a practice change that promotes evidence-based care practices for infants with NAS.	CPGs provide nurses with clear direction when caring for their patients. The guidelines are designed to reduce the withdrawal syptoms and discomfort of the fragile newborn and to nurture the maternal-infant dyad.
Grossman et al, 2017	An initiative to improve the quality of care of infants with NAS	Quality Improvement Project	Yale New Haven Children's Hospital	287 Infants	The outcome measures included ALOS, morphine use, and hospital costs using statistical process control charts.	Interventions focused on nonpharmacologic therapies and a simplified approach to assessment for infants exposed to methadone in utero led to both substantial and sustained decreased in ALOS, the proportion of infants treated with morphine, and hospital costs with no adverse events.
Murphy-Oikonen et al, 2012	To evaluate the effectiveness of a CPG on increasing identification of neonates with NAS symptoms based on a toxicology screening protocol, decreasing the mean NAS score and average LOS.	A Retrospective Cohort Comparison Design	Regional hospital in a mid-size Canadian city	A final sample of 90 neonates demonstrating NAS symptoms were included in this study; 20 in the pre-intervention group, and 70 in the post-intervention group	Retrospective cohort comparison using hospital record data for neonates	There was a significant decrease in the overall average NAS score and in the number of measures taken over time between the two groups. Similarly, the change in CPG led to a reduction in the LOS among post-intervention neonates.

Appendix B – Literature Review Matrix (continued)

Author, Date	Study Purpose	Study Design	Setting	Sample Description, Size	Data Collection Methods	Results
Nelson, 2016	The purpose of the focused ethnography was to desribe the culture of care and nonpharmacologic nursing interventions performed by NICU nurses for infants with NAS.	A focused ethnography	A 44-bed NICU at a children's hospital in the southeastern US	12 full-time nurses	Observation and interviewing	Results described the culture of care provided to infants with NAS by NICU nurses as evidenced by six themes: learn the baby, core team relationships, role satisfaction, grief, making a difference, and education and care of the mother.
Patrick et al, 2016	Patrick et al (2016) designed and implemented a multicenter quality improvement collaborative for infants with NAS. The objective was to determine if the collaborative was effective in standardizing hospital policies and improving patient outcomes.	Quality Improvement Project	199 participating centers in the multicenter, multistate quality improvement collaborative	3,458 infants	Audit data were collected by each center and reported to VON through the use of an online data portal. Hospital standardization was measured through serial assessment of hospital policies.	Of the participating centers, the mean number of NAS-focused guidelines increased from 3.7 to 5.1, with improvements in all domains. Also, LOT decreased from 16 to 15 days and LOS decreased from 21 to 19 days.
Saunders et al, 2014	An evidence-based, multidisciplinary NAS protocol was developed using a stepwise continuous quality improvement (CQI) approach with the goal of standardizing care procedures for these infants.	Quality Improvement Project	East Tennessee Children's Hospital is a 152-bed hospital dedicated to the care of children with a 60 bed level III NICU that admits 600-700 patients annually	413 Infants	Retrospective data analysis with outcome variables of total LOS days, number of days required to wean from opioids, and number of hospital days from opioid wean to discharge, and number of adjunct medications.	The weaning time from opioids remained stable throughout each CQI steps. The overall total NICU LOS was reduced by 10.35 days, and the the LOS after completing wean from opioids was reduced by 2.79 days. Use of adjunct medications decreased from 30.1% to 24.5%.

Manuscript 3

A Mixed Methods Study to Investigate Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS)

Abstract

Background: The incidence of Neonatal Abstinence Syndrome has increased significantly as a result of the opioid epidemic. A lengthy hospitalization is often required to treat the infant's withdrawal symptoms. A comprehensive understanding of factors that influence nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome is needed.

Purpose: To investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome through the lens of the Theoretical Domains Framework.

Methods: A parallel convergent mixed methods study was conducted. Qualitative data were collected using semi-structured interviews and quantitative data were collected using a tailored Determinants of Implementation Behavior Questionnaire with neonatal nurses. Findings from the interviews and surveys were merged through joint review to compare and contrast themes.

Results: Enablers and barriers to nurses' implementation of nonpharmacological interventions included education, experience, ability to implement nonpharmacological interventions, parental participation, stigmatization, lack of managerial/organizational support, staffing ratios, internal and external resources, and stress. *Knowledge*, *Skills*,

Beliefs about Capabilities, *Social/Professional Role and Identity*, *Organization*, and *Emotion* of the Theoretical Domains Framework aligned with these themes.

Implications for Practice: Findings from this study will inform the development of programs to improve nurses' implementation of nonpharmacological interventions and health and utilization outcomes in infants with Neonatal Abstinence Syndrome.

Implications for Research: Future work should focus on the development of programs to improve nurses' implementation of nonpharmacological interventions, with specific strategies aimed to mitigate marginalization of vulnerable patient populations.

Keywords

Neonatal Abstinence Syndrome; neonatal withdrawal; Theoretical Domains Framework; nonpharmacological interventions; nursing interventions; length of stay

Background

Up to 90% of neonates with in-utero opioid exposure experience Neonatal Abstinence Syndrome (NAS),[1] which results in deleterious symptoms and complications, prolonged hospitalization, and extensive pharmacological therapy.[2] In the United States, NAS incidence increased 383% from 2000 to 2012.[3] In 2012, infants with NAS were hospitalized an average of 16.9 days (vs. 2.1 days for healthy newborns), costing an estimated $1.5 billion; the majority of charges (81%) were paid by state Medicaid programs, reflecting the greater tendency of opiate-dependent mothers to be from lower income communities.[4] Opiates (oral morphine, methadone) should be first-line pharmacological treatment for infants with NAS[2]; however, nonpharmacological nursing care is as critical as pharmacologic treatment in decreasing withdrawal symptoms. To date, no research has focused on the barriers and enablers to nurses' implementation of nonpharmacological nursing interventions for this population.

Nonpharmacologic nursing interventions, refinement of nurses' NAS assessment skills, and accurate scoring of NAS withdrawal symptoms significantly reduces the severity of withdrawal, length of treatment (LOT), and length of stay (LOS), and improves maternal and infant outcomes.[5] In contrast, ineffective nursing interventions, inaccurate assessments, and insufficient utilization of abstinence scoring tools contribute to unnecessary pharmacologic treatment, which prolongs drug exposure and hospitalization to the possible detriment of maternal-infant bonding.[6]

Because nonpharmacologic nursing care is not complicated by the potentially harmful side effects of pharmacological treatment, it should be the standard of care for opioid-

exposed infants.[7] Examples of nonpharmacologic nursing interventions include swaddling, providing quiet and low-stimulation environments, rooming-in, skin-to-skin holding, breastfeeding (unless contraindicated), and infant positioning.[8] Mitigating the clinical complications of NAS may improve withdrawal severity, LOT, LOS, cost associated with LOS, and behavioral outcomes including maternal attachment.[9] The purpose of this parallel convergent mixed methods study was to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS through the lens of the Theoretical Domains Framework (TDF).

Theoretical Framework

The TDF provides a means to examine factors that influence healthcare providers' behavior related to the implementation of evidence-based practice and interventions in clinical practice.[10] The TDF succinctly synthesizes various behavior change theories (33 theories and 128 primary theoretical constructs) into one framework for multidisciplinary use.[10] The TDF consists of 14 domains of theoretical constructs: 'Knowledge,' 'Skills,' 'Social/Professional Role and Identity,' 'Beliefs about Capabilities,' 'Optimism,' 'Beliefs about Consequences,' 'Reinforcement,' 'Intentions,' 'Goals,' 'Memory, Attention, and Decision Processes,' 'Environmental Context and Resources,' 'Social Influences,' 'Emotion,' and 'Behavioral Regulation'.[10]

Methods

This convergent parallel mixed methods study was conducted through the lens of the TDF. Quantitative data were collected using a Determinants of Implementation Behavior Questionnaire for Neonatal Abstinence Syndrome (DIBQ-NAS) that assessed nurses'

perceptions of barriers and enablers to implementation of nonpharmacological interventions for infants with NAS. Qualitative semi-structured interviews and thematic analysis were conducted to describe nurses' perceptions of barriers and enablers to implementation of nonpharmacologic nursing interventions. Merging of the interview and DIBQ-NAS results allowed for identification and prioritization of barriers and enablers. Data collection began after approval from the Institutional Review Board and the National Association of Neonatal Nurses (NANN) research committee.

Qualitative Arm

A descriptive qualitative approach[11] was applied to explore nurses' perceptions of barriers and enablers to implementation of nonpharmacological interventions. Purposeful sampling was used to recruit participants from a Level II Neonatal Intensive Care Unit (NICU) at an academic medical center and by offering members of NANN who completed the DIBQ-NAS survey the option to participate in the interview. Participants who met the inclusion and exclusion criteria were enrolled in the study (Table 1).

Table 1. *Qualitative Inclusion and Exclusion Criteria*

Inclusion Criteria	Exclusion Criteria
Nurses must be licensed and registered to practice in their state	Nurses whose primary NAS experience is related to infants withdrawing from opioids/sedatives because the infant is on mechanical ventilation. The type of NAS experience was evaluated by the PI during the participant screening process.
For participants recruited from the Level II NICU, nurses must have at least 6 months' experience caring for infants with NAS.	

Semi-structured interviews were conducted using a guide with 8 open-ended questions, followed by a demographic survey. The interview explored nurses' perceptions

and experiences with caring for infants with NAS; factors that impact the infants' LOS; efficacy of withdrawal scoring instruments; and mothers' responses and interactions with her infant. Interviews were conducted in person, in a private conference room, or via phone according to the participants' preference, audio recorded, and transcribed. Theoretical saturation, the point at which no new information emerges in the data,[12] was met with fifteen participants.

Interviews were analyzed using conventional content analysis[13] to code data into common themes. The TDF was used as an initial coding framework, and the constant-comparative method was applied throughout the process until theoretical saturation was met.

Demographic data were entered into REDCap[14] and exported to SPSSv25[15] for analyses. Descriptive statistics, including frequency distributions, measures of central tendency, and measures of dispersion or variation were computed on the demographic characteristics (gender, age, race/ethnicity, and level of education and nursing experience) of participants as appropriate.

Quantitative Arm

A tailored DIBQ-NAS was administered to assess nurses' perceptions of barriers and enablers to implementation of nonpharmacological interventions. Target sample size was 367 participants based on a 95% confidence interval, a ±5% margin of error and an assumed standard deviation of 0.5.[16] A link to the demographic survey and DIBQ-NAS, administered through REDCap[14] via email, was sent to the membership of NANN (approximately 8200 members). A survey introduction and DIBQ-NAS link were posted

to *MyNANN Community*. Three additional reminders were posted every two weeks. The screening questionnaire reduced the study population to those meeting the inclusion criteria (Table 2).

Table 2. *Quantitative Inclusion and Exclusion Criteria*

Inclusion Criteria	Exclusion Criteria
Nurses must be members of NANN, self-report having at least 6 months' experience caring for infants with NAS and have access to a computer with a valid email address.	None

The DIBQ was developed to measure behavior determinants of the 12-domain version of the TDF.[17] The initial DIBQ contained 100 items assessing the 12 TDF domains. Results obtained from confirmatory factor analysis and Cronbach's alpha resulted in the DIBQ consisting of 93 items assessing an expanded 18 TDF domains, explaining 63.3% of the variance, and internal consistency reliability values ranged from .68 to .93.

The DIBQ was designed to be easily adaptable for use in studies investigating implementation behaviors of healthcare providers in various settings.[18] Therefore, a tailored, more succinct version of the DIBQ was developed for this study, the DIBQ-NAS (Appendix A). Tailoring was informed by findings from an integrative review[5]; the DIBQ-NAS consists of 11 items to assess nurses' perceptions of *Knowledge*, *Skills*, *Social/Professional Role and Identity*, *Beliefs about Capabilities*, *Environmental Context and Resources*, *Organization*, and *Emotion* in caring for infants with NAS and their families. The DIBQ-NAS utilizes a Likert scale for responses, with lower values representing less confidence/agreement and higher values representing greater confidence/agreement. Data from the DIBQ-NAS and demographic surveys were stored

in REDCap[14] and exported to SPSSv25[15] for analyses. Descriptive statistics, including frequency distributions, measures of central tendency, and measures of variation were computed as appropriate.

Merged Analysis

Results from the interviews and DIBQ-NAS were merged through joint display to compare and contrast findings according to TDF domains (Table 3). A frequency analysis was conducted by counting the number of interview participants who contributed to each theme to establish priority barriers and enablers. All themes in which 50% (n = 7) or more participants contributed data were considered priority. In addition, themes not meeting the frequency benchmark but considered highly relevant to the study purpose were also considered priority.

Table 3. *Qualitative and Quantitative Joint Display*

TDF Domains	Qualitative Themes	Illustrative Quotes	DIBQ-NAS Responses
Knowledge **Skills** **Beliefs about Capabilities**	**Nurse Education** **Nurse Experience** **Nurses' Implementation of Interventions**	• *"I think there needs to be more information for consistency of care all around. I think when you don't have primarily the same two, or three, or four nurses taking care of the patient, often the care can vary, and I think the way that we rate our NAS (infants) is still very subjective. I think there's still a lot of lack of education in how we rate it."* • *"I think the longer you're taking care of the children, the easier it gets, and you can feel confident in caring for them and being able to calm them down."* • *"I think the nurses are really important. They provide the soothing mechanisms to be able to hold the babies and score the babies. I feel like we're pretty competent. We're trained, we get that competency, so what we score them is going to impact whether their morphine is weaned or not, and then ultimately, their length of stay."*	• I know how to deliver nonpharmacological interventions, 83.9% strongly agreed, 12.5% agreed, and 3.6% strongly disagreed. • I have been trained in delivering nonpharmacological interventions, 57.1% strongly agreed, 32.1% agreed, 7.1% were neutral, and 3.6% strongly disagreed. • The organization I work in provides nursing staff with training in implementing nonpharmacological interventions, 26.8% strongly agreed, 32.1% agreed, 26.8% were neutral, 12.5% disagreed, and 1.8% strongly disagreed. • For me, performing an accurate withdrawal assessment is..., 25% considered is very easy, 53.6% considered it easy, 10.7% were neutral, and 10.7% found it difficult. • I have the skills to deliver nonpharmacological interventions, 75% strongly agreed, 21.4% agreed, and 3.6% strongly disagreed.
Social/Professional Role and Identity	**Parental Participation** **Lack of Parental Participation** **Stigmatization**	• *"The infants whose parents are committed and are there every day and staying for significant lengths of time, bonding with the baby, holding the baby; they typically have much lower scores and are able to wean faster and get discharged sooner."* • *"I think because the parents can't be there 24/7 because they usually have other kids at home so it's hard, your baby changes every day and it's hard for them to really get to know them, so I do feel like it's hard for them to bond."* • *"I can see that being a perception of the moms, and them not wanting to be in the nursery, because they're afraid of what people are thinking about them."*	Not assessed
Organization	**Lack of Managerial/Organization Support** **Staffing Ratios** **Internal and External Resources**	• *"I would say the hospital approving more nurses to take care of these babies and understanding that sometimes they can be a one on one if they have to be, and supporting that, I would say that's currently not there. So as far as I'm concerned, there really isn't a lot of hospital support at this time."* • *"I think patient ratio is probably the biggest challenge, finding enough time to work with the patient to give them the needed time to give the appropriate care."* • *"volunteers' ability to be there with the baby that's withdrawing, give them that comfort, I think would probably be the most valuable asset and resource that we can provide an NAS baby."*	• I can count on support from management of the organization I work in when it becomes challenging to care for infants with NAS, 33.9% strongly agreed, 35.7% agreed, 17.9% were neutral, 10.7% disagreed, and 1.8% strongly disagreed. • The management of the organization I work in is helpful with delivering care and implementing nonpharmacological interventions, 30.4% strongly agreed, 35.7% agreed, 25% were neutral, 7.1% disagreed, and 1.8% strongly disagreed. • In the organization I work, all necessary resources are available to deliver nonpharmacological interventions, 35.7% strongly agreed, 33.9% agreed, 14.3% were neutral, 14.3% disagreed, and 1.8% strongly disagreed. • I can count on support from other nurses with whom I work when it becomes challenging to provide care, 55.4% strongly agreed, 33.9% agreed, and 5.4% were neutral. • The organization I work in provides assistance to nurses delivering care (for example, volunteers to hold infants), 30.4% strongly agreed, 48.2% agreed, 7.1% were neutral, 12.5% disagreed, and 1.8% strongly disagreed.
Emotion	**Stress (S)**	• *"You want to make them (infants with NAS) feel better. You want to care for them appropriately, but when you feel like you're exhausting all efforts to give them what they need, but it's not what they need, or it's not enough, and they're still just utterly miserable."* •*"I think day in and day out, if it's a really difficult situation, it can definitely be stressful and fatiguing. Eventually at some point they're (nurses) going to need a break."* • *"It wears you down sometimes to take care of these patients because you can't give them what they need, and so it is a little fatiguing to take care of them, especially if you have another patient or two that are taking up a lot of your time."*	• The management of the organization I work in is willing to listen to my problems with delivering care to infants with NAS, 39.3% strongly agreed, 35.7% agreed, 17.9% were neutral, 5.4% disagreed, and 1.8% strongly disagreed.

Results

Fifteen nurses (10 Level II NICU employees, 5 NANN members) participated in interviews (Table 4). Sixty-three nurses responded to the DIBQ-NAS; 5 did not provide responses beyond the screening questions and 2 did not meet the inclusion criteria. The final sample was 56 participants (Table 4).

Results of the frequency analysis led to five TDF domains meeting priority status: *Knowledge*, *Skills*, *Beliefs about Capabilities*, *Social/Professional Role and Identity*, and *Emotion*. The domain *Organization* did not meet the priority benchmark but was considered highly relevant and was included.

Table 4. *Interview and DIBQ-NAS Demographic Statistics*

	Interview Participants (n = 15)	**DIBQ-NAS Participants** (n = 56)
Gender (Female)	93.3% (14/15)	96.4% (54/56)
Prefer Not to Provide	0% (0/15)	1.8% (1/56)
Age in Years		
Mean ± SD (Median)	37.1 ±12 (35)	48.3 ±10.9 (51)
Race/Ethnicity		
Asian		3.6% (2/56)
Hispanic or Latino		1.8% (1/56)
White		84% (47/56)
Asian and White		3.6% (2/56)
Hispanic or Latino and White		1.8% (1/56)
Prefer Not to Provide		5.4% (3/56)
Highest Degree Obtained		
Associates Degree	6.7% (1/15)	3.6% (2/56)
Bachelor's Degree	66.7% (10/15)	39.3% (22/56)
Master's degree	26.7% (4/15)	42.9% (24/56)
Doctoral Degree	0% (0/15)	10.7% (6/56)
Prefer Not to Provide	0% (0/15)	3.6% (2/56)
Years Working as a Nurse		
1-3 years	20% (3/15)	7.1% (4/56)
4-6 years	20% (3/15)	8.9% (5/56)
7 years or more	60% (9/15)	82.1% (46/56)
Prefer Not to Provide	0% (0/15)	1.8% (1/56)

Years Providing Care for Infants with NAS		
Less than one year	0% (0/15)	1.8% (1/56)
1-3 years	20% (3/15)	10.7% (6/56)
4-6 years	26.7% (4/15)	10.7% (6/56)
7 years or more	53.3% (8/15)	75% (42/56)
Prefer Not to Provide	0% (0/15)	1.8% (1/56)
Frequency of Providing Care for Infants with NAS		
Less than once a week	13.3% (2/15)	26.8% (15/56)
About once a week	73.3% (11/15)	41.1% (23/56)
More than once a week	6.7% (1/15)	26.8% (15/56)
Unknown	6.7% (1/15)	3.6% (2/56)
Prefer Not to Provide	0% (0/15)	1.8% (1/56)
Care Setting		
General Service Level 1 Newborn Nursery	0% (0/15)	1.8% (1/56)
General Service Level II Nursery	73.3% (11/15)	19.6% (11/56)
Separate/Designated NAS unit	0% (0/15)	7.1% (4/56)
Neonatal Intensive Care Unit (Level III or greater)	26.7% (4/15)	69.6% (39/56)
Prefer Not to Provide	0% (0/15)	1.8% (1/56)

Knowledge, Skills, and Beliefs about Capabilities

Most participants emphasized the importance of *nurse education* (n = 15), *nurse experience* (n = 12), and *nurses' implementation of nonpharmacological interventions* (n = 10), which align with the TDF *Knowledge, Skills,* and *Beliefs about Capabilities* domains.

Nurse Education. According to participants, *nurse education* is crucial to nurse self-efficacy, empathy, assessment skills, and knowledge of nonpharmacological and pharmacological interventions and the NAS diagnosis. Participants suggested that education may also mitigate potential biases towards mothers/families and their infants. Nurses' knowledge of the maternal, birth, and infant histories also highly impact nursing care. More education ensures consistency and assessment accuracy among care providers and across hospital units. In addition, participants suggested having educational materials

more readily available and accessible, such as imbedded educational scoring tools in charting software as an opportunity for real-time education to increase scoring accuracy.

According to DIBQ-NAS responses, over 90% of nurses believed they knew how to deliver nonpharmacological interventions for infants with NAS; however, only about half of nurses believed they received adequate training on implementing these interventions. The quantitative results further emphasize, as the interviewed participants suggested, the need for more education and training.

Nurse Experience. Participants posited that more experience caring for infants with NAS, specifically assessing and scoring the severity of withdrawal, leads to greater assessment accuracy and overall nurse self-efficacy. According to DIBQ-NAS responses, over 75% of nurses believed performing accurate withdrawal assessments to be easy. Over half of those interviewed and 75% of nurses who completed the DIBQ-NAS had more than 7 years of experience caring for infants with NAS.

Nurses' Implementation of Nonpharmacological Interventions. Participants stated their ability to implement nonpharmacological interventions, including accurate and consistent withdrawal assessments and scoring of withdrawal symptoms, is crucial in determining pharmacological management, which can significantly alter the infant's LOS. In addition, managing withdrawal symptoms and ensuring the infant is feeding well and gaining weight are critical milestones in preparation for hospital discharge.

Nearly all nurses (96%) responded on the DIBQ-NAS that they believed they had the skills to deliver nonpharmacological interventions for infants with NAS. In addition to *consistency* of care, several participants (n = 9) discussed the importance of "continuity

of care" for the NAS parental-infant dyad. Participants indicated that the same nurse (when possible) caring for the infant was instrumental in reducing withdrawal symptoms and LOS and provided more accurate withdrawal assessments. According to participants, "continuity of care" naturally facilitates the nurse-parent relationship bond. Further, communication among nurses on an infant's likes/dislikes of nonpharmacological interventions aids in the delivery of optimal care.

Social/Professional Role and Identity

All participants discussed the importance of creating a welcoming environment to encourage *parental participation* (n = 15) in infant care by including them as an integral part of the care team. Several participants (n = 9) conveyed their concern regarding the *lack of parental participation*, and how parental uninvolvement creates barriers in the care. Numerous participants shared their views regarding how *stigmatization* (n = 8) and the *perception of stigma* (*by parents)* (n = 9) of infants with NAS and their families creates multiple barriers related to parental-infant and nurse-parent relationships. These themes align with the TDF *'Social/Professional Role and Identity'* domain.

Parental Participation. According to participants, the nurses' role is to create a welcoming environment and include parents as an integral part of the care team. A few participants (n = 4) posited that establishing roles, clear boundaries, and expectations can facilitate the development of the nurse-parent relationship. Nurse-guided parental education can improve both parental and infant outcomes. Participants noted that *parental participation* can positively influence self-efficacy, the parental-infant bond, and the relationship between the nurse and parent and may decrease parental guilt, and the

infant's withdrawal scores and LOS. In addition, *parental participation* lends to greater understanding of the NAS condition and pharmacologic treatment. Further, nurses appreciate when parents attempt to understand and care for their infant to prepare for discharge home. This care includes providing soothing techniques similar to those utilized in the hospital, which can make the infant's transition more comfortable.

Conversely, participants (n = 10) discussed the *lack of parental participation* or understanding of the infant's diagnosis and knowledge of appropriate nonpharmacological interventions as barriers to parental education, the development of the nurse-parent relationship, the parental-infant bond, and a source of nurse stress. Several participants (n = 6) described *external factors* such as maternal substance abuse treatment, distance from the hospital, having other children, and having jobs, which limit the time the parent can visit and care for their hospitalized infant and impairs their ability to bond effectively. In addition, separating the mother from her infant due to delivery complications, the initiation of pharmacologic treatment for the infant with NAS, visitation requirements of Children and Family Services, or other complex social issues also present barriers to parental participation and bonding.

Stigmatization. Several participants (n = 8) acknowledged *stigmatization* of parents such as, judgmental statements and rumors during shift report or excluding the parent in infant care, which creates barriers to the development of a positive nurse-parent relationship and adversely impacts the parent's desire to visit, self-efficacy, and bonding with the infant. Participants discussed how even the *perception of stigma* (n = 9) and internalized guilt felt by parents may negatively impact their desire to visit and self-

efficacy. Most participants, regardless of their internal thoughts and beliefs about this opioid-exposed patient population, remain professional, provide the best care, and desire to teach parents infant care.

Organization

All participants (n = 15) addressed concerns regarding the amount of "hands-on" time infants with NAS require and the *lack of managerial/organizational support* (n = 6) as evidenced by *inadequate staffing ratios* (n = 15). Due to inadequate staffing ratios, participants expressed gratitude for and dependence on volunteers *(external team resource*; n = 15), and fellow internal staff members and interdisciplinary team members *(internal team resource*; n = 12) to fully support care standards for infants with NAS and their families. These themes align with the *'Organization'* domain of the TDF.

Lack of Managerial/Organizational Support. Several participants (n = 6) reported management exhibiting a lack of understanding and knowledge of NAS and the time required to care for patients and their families, which led management to question unit staffing ratios. Participants posited that managerial support is needed to ensure appropriate staffing ratios are maintained. Some participants also suggested more managerial presence and support are needed during night/weekend shifts. However, quantitative findings indicated most participants felt supported by management. DIBQ-NAS responses indicated nearly 70% of nurses believed they could count on support from management when it became challenging to care for infants with NAS. Similarly, more than 65% of nurses believed management was helpful with delivering care and implementing nonpharmacological interventions.

Staffing Ratios. Participants stated infants with NAS require more time to care for than the average patient, which should be reflected in staffing ratios. Inadequate staffing ratios limit time with the infant, increase nurse stress, and lead to more errors and inaccurate withdrawal scores. However, DIBQ-NAS responses indicated nearly 70% of nurses believed their organization had all necessary resources available to deliver nonpharmacological interventions. These findings contradict the results from the interviews, which indicated nurses felt "under-staffed" and without enough time to care for infants with NAS properly.

Internal and External Resources. All participants emphasized the importance of volunteers when caring for infants with NAS and their families. They believed that more volunteers are needed, particularly during night and weekend shifts. Participants stated that volunteers are invaluable resources who hold and comfort infants, which reduces withdrawal symptoms and allows nurses to care for other patients. Further, most participants (n = 12) conveyed the importance of "teamwork" and stated that interdisciplinary team support (occupational therapy, physical therapy) can reduce the infant's LOS, and improve care and overall infant outcomes. Participants added that incorporating a "family integrated model of care" allows parents to provide care without depending on the nurse, which promotes flexibility in staffing ratios.

The findings from the DIBQ-NAS were consistent with interview results. Responses on the DIBQ-NAS indicated nearly 90% of nurses believed they could count on support from other nurses when it became challenging to provide care for infants with NAS.

Further, over 75% of nurses believed their organization assists nurses delivering care to infants with NAS.

Emotion

Nurse *stress* was one of the most common themes (n = 15). The sources of stress vary widely, which creates challenges to providing proper support for nurses. The TDF domain most closely aligned with *stress* is *'Emotion'*.

Stress. Several participants (n = 7) said they experience heartbreak and frustration when thinking about the infant's diagnosis, its impact on the infant's life, and the infant's life once discharged from the hospital, all while trying to deliver the best care. The infant's uncertain plan for the future (which may include going home with a foster parent, relative, etc.) impacts the nurses' bond with the infant and leads to stress. The complex social issues often exhibited in families and the amount of education nurses provide to the family also increase nurse stress. Additionally, it can be frustrating and stressful for the nurse who is unable to soothe and comfort an infant experiencing withdrawal. Participants indicated caring for infants with NAS, particularly during consecutive shifts, contributes to nurse stress and fatigue. Participants emphasized the importance of knowing their limitations, relying on resources, and taking breaks.

According to DIBQ-NAS responses, 75% of nurses believed that management was willing to listen to their problems with delivering care to infants with NAS. The merged findings suggest that although nurses experience stress caring for infants with NAS and their families, most nurses feel management is willing to listen to their concerns and challenges.

Discussion

The purpose of this study was to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS through the lens of the TDF. *Knowledge, Skills,* and *Social/Professional Role and Identity* are the most influential TDF domains for providers' implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS.[5] Other potentially influential contextual and environmental TDF domains such as, *Beliefs about Capabilities, Environmental Context and Resources, Organization,* and *Emotion* were also explored in this study.

Knowledge was identified as a key influential TDF domain. Specific and ongoing education related to the NAS continuum of care, from early detection and intervention for mothers and infants at risk through post-discharge identification and utilization of community support services, is crucial to improving overall outcomes.[19] Further, greater knowledge of the NAS diagnosis, treatment modalities, infant comfort measures, and withdrawal assessment criteria enhances nurse self-efficacy,[20-22] mitigates stigmatization of the NAS parental-infant dyad,[23] and enables nurses to effectively implement nonpharmacological interventions.

Once a solid foundation of knowledge has been established, nurses can refine their skill set by gaining more experience in implementing nonpharamcolgoical interventions. *Skill,* another highly influential TDF domain, is established through caring for infants with NAS more frequently, incorporating unit "NAS core teams" (a team of nurses committed to caring for these infants every shift), and when possible, providing

"continuity of care." The synergistic combination of greater knowledge and refined skill results in more accurate withdrawal assessments and consistency in care, which has been shown to decrease infant withdrawal severity and LOS.[24]

Consistency of care was identified as a key enabler to the effective implementation of nonpharmacological interventions. The utilization of a withdrawal protocol is an evidence-based, recommended strategy to establish a consistent, standard of care for infants with NAS.[24-27] Important caveats to this strategy include incorporating nurses' input in the infants' plans of care and recognizing patient individuality. Nurses, due to the considerable amount of time spent caring for the NAS parental-infant dyad, are well positioned to advise the care team and advocate for their patients and families to ensure the best overall outcomes.

Nurses are a crucial component in the delivery of care for infants with NAS; however, most nurses believe that parental participation in care is far more significant, particularly as it relates to parental self-efficacy, parental-infant bonding, and the reduction of infant withdrawal severity and LOS.[28] Therefore, by nurses embracing their unique role and creating a welcoming environment that includes parents as an integral part of the care team, a *family integrated model of care* can be established. This care model has been successful in enhancing the parental-infant bond, limiting treatment with medications, and reducing infant withdrawal severity and LOS.[28]

The successful implementation of a *family integrated model of care* requires unbiased support from interdisciplinary care team members. Although stigmatization of patient populations is of considerable concern to healthcare providers, it is representative of the

more significant issue of societal marginalization of those with Opioid Use Disorder (OUD). Stigmatization of those with OUD by healthcare providers is a significant barrier to effective and optimal treatment for pregnant women.[29] Further, when women with OUD do access healthcare, they often receive misinformation, inaction, and judgmental attitudes by healthcare providers.[30] Findings from this study indicate stigmatization results in barriers to parental participation in infant care, self-efficacy, development of the nurse-parent relationship, and parental-infant bonding. Therefore, due to the significant increase in patients with OUD, healthcare organizations should invest in training and education programs to support providers' delivery of unbiased healthcare to vulnerable patient populations.

Organization was identified as an influential TDF domain, and *organizational support* was a key enabler to nurses' implementation of nonpharmacological interventions. While most patient caregiving responsibilities fall to nurses, healthcare organizations are obligated to ensure care team members are equipped with the necessary resources to deliver optimal care to patients. *Organizational support* not only includes investing in training and education for providers, but also maintaining adequate staffing ratios to ensure more challenging patients receive optimal care. Further, the inclusion and training of volunteers and nursing assistants in comforting infants with NAS was viewed as an extremely valuable resource in this study. Healthcare organizations can support nursing staff by acknowledging and understanding the complexities of NAS care, offering a multidisciplinary caregiving team approach,[24,28] and investing in all necessary resources to assist those who deliver care.

One of the more insidious barriers to nurses' implementation of nonpharamcolgoical interventions was *stress*. Sources of participants' stress varied widely, which complicates organizational efforts to mitigate nurse fatigue and its far-reaching effects.[31] These findings are congruent with other studies that found nurses providing NAS care experienced intensified traumatic experiences,[32] ethical and moral distress,[33] and were at risk for compassion fatigue and burnout.[34] Smith-Miller and colleagues[35] posited that addressing job-related factors could reduce nurse fatigue, errors, attrition and employer costs while improving patient outcomes and job satisfaction among nurses. However, addressing and monitoring fatigue in healthcare organizations remains challenging due to lack of evidence-based fatigue policies.[31] Despite the lack of evidence-based fatigue policies, healthcare organizations should create a culture of safety by collaborating with nurse leaders to develop strategies to manage nurse fatigue.[31]

Limitations

The development of the DIBQ-NAS was informed by findings of an integrative review[5], in which the TDF domains *Knowledge*, *Skills*, and *Social/Professional Role and Identity* were identified as having the greatest influence on providers' implementation of nonpharmacological interventions to decrease the LOS for infants with NAS. Results from the qualitative analysis identified other areas related in the *Social/Professional Role and Identity* domain, such as *parental participation, lack of parental participation*, and *stigmatization* that should be included in an expanded version of the DIBQ-NAS. Despite attempts to recruit the targeted 367 participants, only 56 nurses completed the DIBQ-NAS. The small sample limited the ability to conduct linear modeling and predictive

statistical analyses. Also, volunteer sampling approaches were used in this exploratory study, which could limit the generalizability of the findings.

Implications for Practice

Nurses consistently rate higher in honesty and ethics than all other professions,[36] comprise the majority of healthcare providers,[37] deliver the most frequent, direct care to patients, and are poised to transform the *model* and *delivery* of care for infants with NAS and their families. Nurses have a unique role in delivering care to vulnerable and marginalized patient populations, such as the NAS parental-infant dyad, and therefore require training and educational programs on OUD and associated sequelae. Findings from this study will inform the development of programs to improve nurses' implementation of nonpharmacological interventions and health and utilization outcomes in infants with NAS.

Implications for Research

Future research should focus on the development of programs to improve nurses' implementation of nonpharmacological interventions for infants with NAS, with specific strategies aimed to mitigate marginalization of vulnerable patient populations. Further, the DIBQ-NAS should be expanded to include questions related to key themes identified through qualitative analysis such as *parental participation*, *lack of parental participation*, and *stigmatization,* which aligned with the *Social/Professional Role and Identity* TDF domain.

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Appendix A: DIBQ-NAS

Adapted from the DIBQ Final questionnaire

For the purpose of completing this survey, the definition of **"nonpharmacological intervention(s)"** includes the following nursing activities:

- Withdrawal assessment of the infant with Neonatal Abstinence Syndrome (NAS)
- Provision of caregiving interventions; for example, swaddling, holding, breastfeeding support when indicated, non-nutritive sucking, inclusion of the mother in the care of her infant
- Utilization of a withdrawal scoring instrument

1. I know how to deliver nonpharmacological interventions for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

2. I have been trained in delivering nonpharmacological interventions for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

3. I have the skills to deliver nonpharmacological interventions for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

4. In the organization I work, all necessary resources are available to deliver nonpharmacological interventions to infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

5. I can count on support from management of the organization I work in, when it becomes challenging to provide care for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

6. The management of the organization I work in is willing to listen to my problems with delivering care to infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

7. The management of the organization I work in is helpful with delivering care and implementing nonpharmacological interventions for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

Appendix A: DIBQ-NAS (continued)

8. The organization I work in provides nursing staff with training in implementing nonpharmacological interventions for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

9. For me, performing an accurate withdrawal assessment for infants with NAS is…

_____Very difficult _____Difficult _____Easy _____Very easy

10. The organization I work in provides assistance to nurses in delivering care to infants with NAS. (for example, volunteers who hold infants).

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

11. I can count on support from other nurses with whom I work when it becomes challenging to provide care for infants with NAS.

_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

If you are interested in participating in a telephone interview regarding nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS, please indicate your interest by checking next to the 'Yes' statement below.

_____Yes, I am interested in participating in a telephone interview.

Supplemental Appendix 1: DIBQ-NAS Statistics Matrix

DIBQ-NAS NANN Survey Descriptive Statistics (n = 56)					
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I know how to deliver nonpharmacological interventions for infants with NAS.	83.9% (47)	12.5% (7)	0% (0)	0% (0)	3.6% (2)
I have been trained in delivering nonpharmacological interventions for infants with NAS.	57.1% (32)	32.1% (18)	7.1% (4)	0% (0)	3.6% (2)
I have the skills to deliver nonpharmacological interventions for infants with NAS.	75% (42)	21.4% (12)	0% (0)	0% (0)	3.6% (2)
In the organization I work, all necessary resources are available to deliver nonpharmacological interventions to infants with NAS.	35.7% (20)	33.9% (19)	14.3% (8)	14.3% (8)	1.8% (1)
I can count on support from management of the organization I work in, when it becomes challenging to provide care for infants with NAS.	33.9% (19)	35.7% (20)	17.9% (10)	10.7 (6)	1.8% (1)
The Management of the organization I work in is willing to listen to my problems with delivering care for infants with NAS.	39.3% (22)	35.7% (20)	17.9% (10)	5.4% (3)	1.8% (1)
The management of the organization I work in is helpful with delivering care and implementing nonpharmacological interventions for infants with NAS.	30.4% (17)	35.7% (20)	25% (14)	7.1% (4)	1.8% (1)
The organization I work in provides nursing staff with training in implementing nonpharmacological interventions for infants with NAS.	26.8% (15)	32.1% (18)	26.8% (15)	12.5% (7)	1.8% (1)
I can count on support from other nurses with whom I work when it becomes challenging to provide care for infants with NAS.	55.4% (31)	39.3% (22)	5.4% (3)	0% (0)	0% (0)
The organization I work in provides assistance to nurses delivering care to infants with NAS. (for example, volunteers to hold infants)	30.4% (17)	48.2% (27)	7.1% (4)	12.5% (7)	1.8% (1)
	Very Easy	**Easy**	**Neutral**	**Difficult**	**Very Difficult**
For me, performing an accurate withdrawal assessment for infants with NAS is…	25% (14)	53.6% (30)	10.7% (6)	10.7% (6)	0% (0)
For the purpose of completing the survey, the definition of "nonpharmacological intervention(s)" included the following nursing activities: • Withdrawal assessment of the infant with NAS • Provision of caregiving interventions; for example, swaddling, holding, breastfeeding support when indicated, non-nutritive sucking, and the inclusion of the mother/parent in the care of the infant • Utilization of a withdrawal scoring instrument					
Abbreviation: NAS, Neonatal Abstinence Syndrome **Percentages are listed and frequencies are in parentheses.*					

Table Legend

Table 1: **Qualitative Inclusion and Exclusion Criteria**

Table 2: **Quantitative Inclusion and Exclusion Criteria**

Table 3: **Qualitative and Quantitative Joint Display**

Table 4: **Interview and DIBQ-NAS Demographic Statistics**

Supplemental Appendix 1: **DIBQ-NAS Statistics Matrix**

Summary

Overview

This dissertation study is comprised of three manuscripts, each contributing to the identification and examination of key barriers and enablers to healthcare providers' implementation of nonpharmacological interventions in the care of infants with Neonatal Abstinence Syndrome (NAS) and their families. The first manuscript is a scoping review of the literature on the benefits of breastmilk for the methadone dependent maternal-infant dyad. The second manuscript is an integrative review which identified the factors that influence healthcare providers' behaviors in the care of infants with NAS. The third and final manuscript explores barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS.

The scoping review, guided by the Social Ecological Model (SEM), served as the foundation for the dissertation study. Research has shown that despite the American Academy of Pediatrics' recommendation for mothers in methadone treatment to breastfeed, breastfeeding is initiated at significantly lower rates than in the general population (1). Understanding this discrepancy and the factors associated with infant feeding decisions is important because breastfeeding has been shown to be a key nonpharmacologic intervention that decreases infant withdrawal severity and length of stay (LOS) (2-8), while improving infant nutrition, and promoting maternal self-efficacy and maternal-infant bonding (6, 9-11). The scoping review findings suggested that many barriers prevent mothers in methadone treatment from breastfeeding, including: inconsistent advice from healthcare providers; lack of clear guidelines; feeding problems

(associated with NAS sequalae); lengthy hospital stays that prohibit maternal-infant bonding; and issues such as low self-esteem, lack of knowledge, or feelings of maternal guilt (6, 12, 13). Health care providers should be knowledgeable about current breastfeeding guidelines for mothers in methadone treatment so they are better equipped to offer nonjudgmental, supportive counsel regarding common breastfeeding challenges and maternal concerns (14).

The integrative review, guided by the Whittemore and Knafl methodology (15), was the keystone for this dissertation study. The *keystone* is a central component on which all else depends. The Theoretical Domains Framework (TDF) served as the lens through which the current knowledge of individual and contextual factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions was examined. The integrative review findings were critical to this dissertation study because the most influential TDF domains relevant to implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS were identified, which included *Knowledge*, *Skills*, and *Social/Professional Role and Identity*.

The primary themes within the TDF domains included: knowledge of NAS and American Academy of Pediatrics recommendations on NAS management, nursing competence (assessment skills and effective utilization of a withdrawal scoring instrument), development of interpersonal relationships with parents within professional boundaries, establishment of role within a multidisciplinary team, and leadership in the management and care of infants with NAS. In addition to the *Knowledge*, *Skills*, and *Social/Professional Role and Identity* domains, other potentially influential contextual

and environmental TDF domains such as, *Beliefs about Capabilities*, *Environmental Context and Resources*, *Organization*, and *Emotion* were incorporated into the dissertation study to ensure the inclusion of all potential barriers and enablers to nurses' implementation of nonpharmacological nursing interventions.

The final manuscript presents findings from a convergent parallel mixed methods study, conducted through the lens of the TDF, which identifies and prioritizes barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS. Joint review of qualitative and quantitative data was conducted, and the most influential enablers and barriers were as follows: nurse education, nurse experience, nurses' ability to implement nonpharmacological interventions, parental participation, stigmatization, lack of managerial/organizational support, staffing ratios, internal and external resources, and stress. The TDF domains *Knowledge*, *Skills*, *Beliefs about Capabilities*, *Social/Professional Role and Identity*, *Organization*, and *Emotion* aligned with these themes.

Importance of Theoretical Framework

The TDF, a theoretical framework comprised of behavior change theories, provides a structure to examine factors that influence healthcare providers' behavior related to the implementation of evidence-based practice and interventions in clinical practice (16). The TDF was instrumental in this dissertation work because it provided the lens through which influential factors in healthcare providers' behaviors were identified during the integrative review and served as the initial coding framework to identify specific themes in the dissertation study. The TDF was selected as the guiding theoretical

framework for this dissertation study because the TDF was developed as a multidisciplinary tool to aid in the identification of influential behavioral factors to develop effective strategies when implementing evidence-based interventions.

Limitations and Lessons Learned

The development of the tailored survey instrument for the dissertation study, the Determinants of Implementation Behavior Questionnaire for Neonatal Abstinence Syndrome (DIBQ-NAS), was informed by findings of the integrative review, in which the TDF domains *Knowledge, Skills,* and *Social/Professional Role and Identity* had the greatest influence on providers' implementation of nonpharmacological interventions. However, results from the qualitative analysis indicated other themes in the *Social/Professional Role and Identity* domain, such as *parental participation*, *lack of parental participation*, and *stigmatization* should be included in an expanded version of the DIBQ-NAS.

Further, application of the TDF in the integrative review was challenging because not all domains are mutually exclusive. To mitigate this challenge in the dissertation study, data from participant interviews were analyzed using conventional content analysis (17) to code data into themes. The TDF was the initial coding framework and the constant-comparative method of data analysis was used throughout the process until theoretical saturation was met.

In addition, despite attempts to recruit the goal of 367 participants for the DIBQ-NAS, such as sending reminders and offering gift card drawings, only 56 nurses completed the survey. The small sample size limited the ability to conduct linear

modeling and predictive statistical analyses. Volunteer sampling was used in this dissertation study, which may limit the generalizability of findings.

Research Trajectory

In response to recollection of a meaningful verse, "the dissertation is not my last word, rather it's my first word," the immediate next step in this research trajectory will be to craft and submit two additional manuscripts presenting the findings from this dissertation study.

More distal next steps in the trajectory will include expansion of the DIBQ-NAS to include questions related to key themes identified through qualitative analysis such as *parental participation*, *lack of parental participation*, and *stigmatization*, which aligned with the *Social/Professional Role and Identity* TDF domain. While these themes were considered high priority according to the qualitative frequency analysis, there were no correlating survey questions that addressed these key themes. In addition, the findings from this study will inform the development of programs to improve nurses' implementation of nonpharmacological interventions in the care of infants with NAS, with specific strategies aimed to mitigate marginalization of vulnerable patient populations.

Contribution to Nursing and Clinical Care

Although significant research has been dedicated to pharmacologic treatment for infants with NAS, there are very few studies that provide empirical evidence to guide specific nonpharmacological interventions aimed to decrease the LOS for infants with NAS. Further, until this dissertation study, there were no studies that incorporated the

TDF as a structure to guide the development of strategies that influence healthcare providers' behavior related to the implementation of evidence-based practice and interventions in clinical practice.

Through a scoping review, the benefits of breastmilk for the opioid-dependent maternal-infant dyad were identified, factors associated with breastfeeding initiation for the opioid-dependent maternal-infant dyad as they correlated to the SEM were evaluated, and the importance of treating the infant with NAS as part of the maternal-infant dyad was established. Further, health outcomes for the NAS maternal-infant dyad can be improved through interventions that create a more welcoming, nonjudgmental, and comfortable environment.

Factors that influence healthcare providers' behaviors in implementing nonpharmacological interventions to decrease the LOS for infants with NAS were identified through an integrative review. Key factors included implementing evidence-based protocols, providing specialized training programs for healthcare providers, including parents as an integral part of the care team; utilizing validated withdrawal scoring instruments; and incorporating interdisciplinary team members in the care of infants with NAS to improve outcomes.

Finally, results from the dissertation study can be applied to develop programs to improve nurses' implementation of nonpharmacological interventions in the care of infants with NAS and their families. The most influential enablers and barriers to nurses' implementation of nonpharmacological interventions were education, experience, ability to implement nonpharmacological interventions, parental participation, stigmatization,

lack of managerial/organizational support, staffing ratios, internal and external resources, and stress. These qualitative themes correlate to the TDF domains *Knowledge*, *Skills*, *Beliefs about Capabilities*, *Social/Professional Role and Identity*, *Organization*, and *Emotion*. Findings indicate key areas that programs should target to improve nurses' implementation of nonpharmacological nursing interventions in the care of infants with NAS and their families.

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APPENDIX A. - Journal of Neonatal Nursing Approval

Article title: Factors Influencing Healthcare Providers' Behaviors in the Care of Infants with Neonatal Abstinence Syndrome (NAS): An Integrative Review

Article reference: JNN971

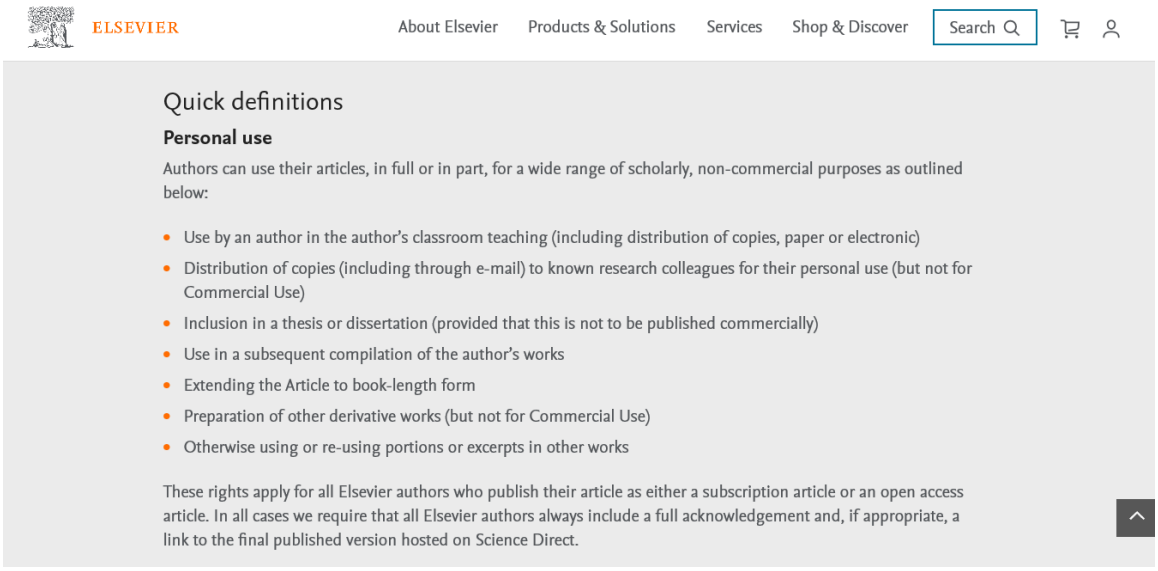
Journal title: Journal of Neonatal Nursing

Corresponding author: Mrs. Allison Adrian

First author: Mrs. Allison Adrian

Online publication complete: 30-JUL-2019

DOI information: 10.1016/j.jnn.2019.07.006



APPENDIX B. – IRB Approval

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL:
This is to certify that the research proposal **Pro00080105** entitled:
A Mixed Methods Study to Investigate Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

Submitted by: **Allison Adrian**
Department: **Medical University of South Carolina**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved. In accordance with 45 CFR 46.101(b)(2), the referenced study is exempt from Human Research Subject Regulations. No further action or Institutional Review Board (IRB) oversight is required, as long as the project remains the same. However, you must inform this office of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Because this project was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

Research related records should be retained for a minimum of three years after termination of the study.

Approval Date: **8/20/2018**

Type: **Exempt**

Administrator, **IRB - Medical University of South Carolina**
Katherine Bright∗

***Electronic Signature**: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

APPENDIX C. – IRB Approval – Amendment 1

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL: **Protocol: MS1_Pro00080105**
MUSC Amendment #: Ame1_Pro00080105
Amendment Title: Amendment 1 for IRB Study #Pro00080105

This is to certify that the amendment to the research proposal entitled:
A Mixed Methods Study to Investigate Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

Submitted by: **Allison Adrian**
Department: **Medical University of South Carolina**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this amendment, except to provide information as requested by the IRB. If this amendment required a change in the currently approved Informed Consent, then all previous Informed Consent documents should be marked obsolete.

Approval Date: **10/17/2018**

Amendment Type: **Expedited**

Chairman, IRB I - Medical University of South Carolina
*** Mark Hamner, MD**

* ***Electronic Signature****: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

APPENDIX D. – IRB Approval – Amendment 2

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL: **Protocol: MS2_Pro00080105**
MUSC Amendment #: Ame2_Pro00080105
Amendment Title: Amendment 2 for IRB Study #Pro00080105

This is to certify that the amendment to the research proposal entitled:
A Mixed Methods Study to Investigate Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

Submitted by: **Allison Adrian**
Department: **Medical University of South Carolina**

for consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of individuals involved, employing adequate methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. No IRB member who has a conflicting interest was involved in the review or approval of this amendment, except to provide information as requested by the IRB. If this amendment required a change in the currently approved Informed Consent, then all previous Informed Consent documents should be marked obsolete.

Approval Date: **2/8/2019**

Amendment Type: **Expedited**

Chairman, IRB I - Medical University of South Carolina
*** Mark Hamner, MD**

* ***Electronic Signature****: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

APPENDIX E. – NANN Approval

Hi Allison,

I'm following up to let you know the NANN Research Committee has reviewed your updated survey request and has approved it for distribution on MyNANN and E-News. Attached is instructions to posting your research survey to MyNANN. Since your initial application, approved surveys are now shared in NANN's bi-monthly newsletter if space allows for it. If you would like to have your survey shared in the next E-News, we will need a two-sentence drafted introduction that shares the purpose of the survey, deadline, and preferred audience, if specific, as well as a link to your survey if that has not yet been provided.

Congratulations on your survey request getting approved. Please let me know if you have any further questions or concerns.

Thank you,

Anna Lapso
Education Coordinator

NANN is going to Savannah, Georgia for our 35th Annual Conference, October 9-12, 2019!

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APPENDIX F. – Demographic Survey for Manuscript 3

Appendix 1 – Demographic Survey for Neonatal Nurses

1. What is your gender?

_____

2. What is your age?

_____

3. What is your race?

_____

4. Are you of Hispanic origin?

_____

5. What is your highest degree obtained?

_____

6. How long have you been working as a nurse (in years and months)?

_____

7. How long have you been providing care for infants with Neonatal Abstinence Syndrome (NAS)?

_____

8. How frequently do you provide care for infants with Neonatal Abstinence Syndrome (NAS)?

_____

9. What is the care setting in which you provide care for infants with Neonatal Abstinence Syndrome (NAS)? (i.e., are infants with NAS cared for in a separate unit or in a general service Level II nursery?)

_____

APPENDIX G. – Interview Guide for Manuscript 3

Appendix 2 – Interview Guide for Neonatal Nurses

Opening

Hello, Thank you for meeting with me today and consenting to discuss your professional insight regarding the care provided for infants diagnosed with Neonatal Abstinence Syndrome (NAS).
My name is Allison Adrian, and I am a doctoral student in the nursing research program at the College of Nursing at the Medical University of South Carolina. This interview, a component of a mixed methods study, will be audio recorded, transcribed, and analyzed.

Introduction

Your privacy and anonymity is of utmost importance; therefore, your identity will be kept confidential. Discussing sensitive subject matter, such as the care of infants with NAS, can be emotionally troubling; if at any point during the interview you feel unable to continue, please feel free to stop the interview. We can continue and/or reschedule the interview at your convenience. The interview will be audio recorded for transcription purposes and will last approximately 45 minutes. The audio recording will be destroyed immediately after the information has been transcribed and analyzed. The information gained from this interview will provide insight and rich data regarding nurses' perceptions of providing care for infants with NAS.

Questions

1. Please describe your experience as a nurse caring for infants diagnosed with Neonatal Abstinence Syndrome (NAS).

Prompts

a. What challenges/frustrations do you experience when providing care for infants with NAS?
b. What resources/support do you have available when providing care for infants with NAS?
c. What resources do you feel are needed when providing care for infants with NAS?

2. What factors do you believe impact the length of stay for infants with NAS?

a. What impact do you believe nursing care has on the length of stay for infants with NAS?
b. What impact do you believe the NAS pharmacological protocol has on the length of stay for infants with NAS?
c. What impact do you believe the neonatologists' methodology has on the length of stay for infants with NAS?
d. What impact do you believe parents have on the length of stay for infants with NAS?
e. What do you think would help reduce the length of stay for infants with NAS?

3. What are your perceptions regarding the modified Finnegan scoring tool (F-NAST) in the care of infants with NAS?

Prompts

a. What education did you receive during orientation/training regarding the assessment of infants with NAS and the utilization of the modified Finnegan scoring tool? How would you modify, if at all, the education and/or how it is currently implemented?
b. How confident do you feel in your ability to accurately assess and score an infant with NAS?

Appendix 2 – Interview Guide for Neonatal Nurses (continued)

c. How important do you believe education is in developing a nurses' confidence in their ability to accurately assess and score an infant with NAS?

4. Please describe the hospital's role in supporting nursing care of infants with NAS?

Thank you very much for your responses to my questions so far – I would like to change topics and discuss your thoughts regarding the relationship between the nurse and the mother of the infant with NAS.

5. Please share your thoughts on the role the care provider-mother relationship plays in the infant's progress.

a. Do you feel that stigma exists between nurses and mothers of infants with NAS?
b. Have you ever witnessed a mother being stigmatized by a nurse? If so, please share your experience.

6. Do you think the mother's perception of stigma (whether it exists or not) has an impact on the maternal-infant bond? (i.e., Do you feel it impacts the mother's visiting time, care she provides her infant, her self-confidence in caring for her infant?)

7. Generally speaking, what are your perceptions regarding the mother's responses and interactions with her infant with NAS?

a. Based upon your experience, do you feel mothers are able to bond with their infants? Please discuss your perceptions of facilitators and/or barriers to the mother-infant bonding process.

8. How important do you believe the following factors are in caring for infants with NAS; a nurse's personality, nursing experience, knowledge of condition, knowledge of nursing interventions?

a. Were you taught (nonpharmacological) nursing interventions to calm and soothe infants with NAS?
b. Do you think nurses experience more fatigue and distress when caring for infants with NAS?
c. Do you feel the acuity ranking of infants with NAS (nurse workload) is accurate?

Closing

I greatly appreciate you sharing your perspective regarding this vulnerable mother-infant dyad. Please share any other thoughts or suggestions you may have with regard to caring for these infants or the questions that have been asked during this interview. If necessary, would it be acceptable for me to contact you for clarifications during the transcription and analytical phase of data collection? I will provide you with a brief summary of the findings and major themes identified once data collection and data analysis has been completed. Thank you again for your participation.

APPENDIX H. – DIBQ-NAS Questionnaire for Manuscript 3

Appendix 3 – DIBQ-NAS

Adapted from the DIBQ Final questionnaire

For the purpose of completing this survey, the definition of **"nonpharmacological intervention(s)"** includes the following nursing activities:

- Withdrawal assessment of the infant with Neonatal Abstinence Syndrome (NAS)
- Provision of caregiving interventions; for example, swaddling, holding, breastfeeding support when indicated, non-nutritive sucking, inclusion of the mother in the care of her infant
- Utilization of a withdrawal scoring instrument

1. I know how to deliver nonpharmacological nursing interventions for infants with NAS.
(Domain: Knowledge; Construct: Knowledge)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

2. I have been trained in delivering nonpharmacological nursing interventions for infants with NAS.
(Domain: Skills; Construct: Skills)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

3. I have the skills to deliver nonpharmacological nursing interventions for infants with NAS.
(Domain: Skills; Construct: Skills)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

4. In the organization I work, all necessary resources are available to deliver nonpharmacological interventions to infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

5. I can count on support from management of the organization I work in, when it becomes challenging to provide care for infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

6. The management of the organization I work in is willing to listen to my problems with delivering care to infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

7. The management of the organization I work in is helpful with delivering care and implementing nonpharmacological interventions for infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

Appendix 3 – DIBQ-NAS (continued)

8. The organization I work in provides nursing staff with training in implementing nonpharmacological interventions for infants with NAS.
(Domain: Innovation strategy; Construct: Innovation strategies)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

9. For me, performing an accurate withdrawal assessment for infants with NAS is…
(Domain: Beliefs about capabilities; Construct: Perceive behavioral control)
_____Very difficult _____Difficult _____Easy _____Very easy

10. The organization I work in provides assistance to nurses in delivering care to infants with NAS. (for example, volunteers who hold infants).
(Domain: Innovation strategy; Construct: Innovation strategies)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

11. I can count on support from other nurses with whom I work when it becomes challenging to provide care for infants with NAS.
(Domain: Social Influences; Construct: Social support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

If you are interested in participating in a telephone interview regarding nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS, please indicate your interest by checking next to the 'Yes' statement below.
_____Yes, I am interested in participating in a telephone interview.

APPENDIX I. – Information for Interview Participants for Manuscript 3

Appendix 4 - Information for Interview Participants document

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

You are being asked to participate in a research study. A study to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome (NAS) will be conducted to inform the development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of a vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

We will be recruiting nurses who are familiar with Neonatal Abstinence Syndrome (NAS) and have at least 6 months of experience caring for infants diagnosed with NAS. Study participants will be nurses recruited from the Level 2 Neonatal Nursery at the Medical University of South Carolina (MUSC) and the National Association of Neonatal Nurses (NANN).

Study participants will be asked to complete a demographic survey and interview with the principal investigator, which should take approximately 45 minutes. The interviews will be conducted in a private conference room at the Children's Hospital at MUSC, or via phone or videoconference according to the participants' preference. Study participants recruited from NANN will be asked to complete a demographic survey administered through REDCap via email.

Your confidential participation in this study is voluntary. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad. If you are interested in being a part of this study, or if you would like more information, please call or email Allison at (843) 819-8946 or adrian@musc.edu.

Thank you,
Allison Adrian, BSN, RN
Principal Investigator

APPENDIX J. – Information for Survey Participants for Manuscript 3

Appendix 5 - Information for Survey Participants document

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

You are being asked to participate in a research study. A study to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome (NAS) will be conducted to inform the development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of a vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

We will be recruiting nurses who are familiar with Neonatal Abstinence Syndrome (NAS) and have at least 6 months of experience caring for infants diagnosed with NAS. Study participants will be recruited from the National Association of Neonatal Nurses (NANN) utilizing the NANN *Listservs* resource. Study participants will be asked to complete a demographic survey and a tailored Determinants of Implementation Behavior Questionnaire (DIBQ-NAS), administered via REDCap through email, which should take approximately 10 minutes.

Your confidential participation in this study is voluntary. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad. If you are interested in being a part of this study, or if you would like more information, please call or email Allison at (843) 819-8946 or adrian@musc.edu.

Thank you,
Allison Adrian, BSN, RN
Principal Investigator

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

IRB Number: Pro00080105
Date Approved: 08/20/2018

APPENDIX K. – Recruitment Flyer for Manuscript 3

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

You are being asked to participate in a research study.

A study to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome (NAS) will be conducted to inform the development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of a vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

- We will be recruiting nurses who are familiar with Neonatal Abstinence Syndrome (NAS) and have at least 6 months of experience caring for infants diagnosed with NAS. Study participants will be nurses recruited from the Level 2 Neonatal Nursery at the Medical University of South Carolina (MUSC) and the National Association of Neonatal Nurses (NANN).
- Study participants will be asked to complete a demographic survey and interview with the principal investigator, which should take approximately 45 minutes. The interviews will be conducted in a private conference room at the Children's Hospital at MUSC, or via phone or videoconference according to the participants' preference. Study participants recruited from NANN will be asked to complete a demographic survey administered through REDCap via email.
- Your confidential participation in this study is voluntary. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad.

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APPENDIX L. – REDCap Survey for Manuscript 3

Confidential

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS)

You are being asked to participate in a research study.

A study to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome (NAS) will be conducted to inform the development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of a vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

● We will be recruiting nurses who are familiar with Neonatal Abstinence Syndrome (NAS) and have at least 6 months of experience caring for infants diagnosed with NAS. Study participants will be nurses recruited from the National Association of Neonatal Nurses (NANN) and the Level 2 Neonatal Nursery at the Medical University of South Carolina (MUSC).

● Study participants will be asked to complete a Determinants of Implementation Behavior Questionnaire - NAS (DIBQ-NAS) and a demographic survey administered through REDCap via email. In addition, participants will have the opportunity to be interviewed by the principal investigator, which should take approximately 30-45 minutes. The interviews will be conducted in a private conference room at the Children's Hospital at MUSC, or via phone or videoconference according to the participants' preference.

● Participating in this survey constitutes permission. All survey results are anonymous and confidential. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad.

● This survey was approved by NANN's Research Committee to be distributed via NANN's social media and/or the My NANN Community. This survey was approved by the Institutional Board for Human Research (IRB), Office of Research Integrity (ORI) with the Medical University of South Carolina (Pro00080105).

Please complete the survey below.

Thank you!

Principal Investigator

Allison Adrian BSN, RN

(843) 819-8946

Medical University of South Carolina

Office of Research Integrity

(843) 792-4148

Confidential

I am a licensed and registered nurse.

◯ Yes
◯ No

I have at least six months' experience caring for infants with neonatal abstinence syndrome.

◯ Yes
◯ No

My primary experience with caring for infants with neonatal abstinence syndrome is due to maternal opiate exposure and NOT related to infants who were mechanical ventilated.

◯ Yes
◯ No

Confidential

Adapted from the DIBQ final questionnaire

For the purpose of completing this survey, the definition of "nonpharmacological intervention(s)" includes the following nursing activities:

- Withdrawal assessment of the infant with Neonatal Abstinence Syndrome (NAS)
- Provision of caregiving interventions; for example, swaddling, holding, breastfeeding support when indicated, non-nutritive sucking, inclusion of the mother in the care of her infant
- Utilization of a withdrawal scoring instrument

I know how to deliver nonpharmacological nursing interventions for infants with NAS.

◯ Strongly Disagree
◯ Disagree
◯ Neutral
◯ Agree
◯ Strongly Agree
◯ Prefer not to provide

I have been trained in delivering nonpharmacological nursing interventions for infants with NAS.

◯ Strongly Disagree
◯ Disagree
◯ Neutral
◯ Agree
◯ Strongly Agree
◯ Prefer not to provide

I have the skills to deliver nonpharmacological nursing interventions for infants with NAS.

◯ Strongly Disagree
◯ Disagree
◯ Neutral
◯ Agree
◯ Strongly Agree
◯ Prefer not to provide

In the organization I work, all necessary resources are available to deliver nonpharmacological interventions to infants with NAS.

◯ Strongly Disagree
◯ Disagree
◯ Neutral
◯ Agree
◯ Strongly Agree
◯ Prefer not to provide

Confidential

I can count on support from management of the organization I work in, when it becomes challenging to provide care for infants with NAS.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Prefer not to provide

The management of the organization I work in is willing to listen to my problems with delivering care for infants with NAS.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Prefer not to provide

The management of the organization I work in is helpful with delivering care and implementing nonpharmacological interventions for infants with NAS.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Prefer not to provide

The organization I work in provides nursing staff with training in implementing nonpharmacological interventions for infants with NAS.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Prefer not to provide

For me, performing an accurate withdrawal assessment for infants with NAS is...

- ◯ Very Difficult
- ◯ Difficult
- ◯ Neutral
- ◯ Easy
- ◯ Very Easy
- ◯ Prefer not to provide

I can count on support from other nurses with whom I work when it becomes challenging to provide care for infants with NAS.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Prefer not to provide

Confidential

The organization I work in provides assistance to nurses in delivering care to infants with NAS. (for example, volunteers who hold infants)

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly Agree
- ◯ Prefer not to provide

APPENDIX L. – REDCap Survey for Manuscript 3 (continued)

-- DEMOGRAPHICS --

What is your gender?

◯ Female
◯ Male
◯ Prefer not to provide

APPENDIX L. – REDCap Survey for Manuscript 3 (continued)

Confidential

What is your age?

- ◯ Prefer not to provide
- ◯ 20
- ◯ 21
- ◯ 22
- ◯ 23
- ◯ 24
- ◯ 25
- ◯ 26
- ◯ 27
- ◯ 28
- ◯ 29
- ◯ 30
- ◯ 31
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- ◯ 59
- ◯ 60
- ◯ 61
- ◯ 62
- ◯ 63
- ◯ 64
- ◯ 65
- ◯ 66
- ◯ 67
- ◯ 68
- ◯ 69
- ◯ 70

What is your race? Please select all that apply.

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Hispanic or Latino
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Prefer not to provide

Confidential

What is your highest degree obtained?

◯ Associate's Degree
◯ Bachelor's Degree
◯ Master's Degree
◯ Doctoral Degree
◯ Prefer not to provide

How long have you been working as a nurse?

◯ Less than 1 year
◯ 1 to 3 years
◯ 4 to 6 years
◯ 7 years or more
◯ Prefer not to provide

How long have you been providing care for infants with Neonatal Abstinence Syndrome (NAS)?

◯ Less than 1 year
◯ 1 to 3 years
◯ 4 to 6 years
◯ 7 years or more
◯ Unknown
◯ Prefer not to provide

How frequently do you provide care for infants with Neonatal Abstinence Syndrome (NAS)?

◯ Less than once a week
◯ About once a week
◯ More than once a week
◯ Unknown
◯ Prefer not to provide

What is the care setting in which you provide care for infants with Neonatal Abstinence Syndrome (NAS)?

◯ General Service Level 1 Newborn Nursery
◯ General service Level II Nursery
◯ Separate/Designated NAS unit
◯ Neonatal Intensive Care Unit (Level III or greater)
◯ Prefer not to provide

APPENDIX M. – Protocol for Manuscript 3

Medical University of South Carolina
Protocol

PI Name: Allison S. Adrian

Study Title: **A Mixed Methods Study to Investigate Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).**

TABLE OF CONTENTS

A. SPECIFIC AIMS

Specific Aims

Among neonates with in-utero exposure to opioids, an estimated 60-90% experience drug withdrawal, a condition defined as Neonatal Abstinence Syndrome (NAS) (1). In the United States, the incidence of NAS increased 383% from 2000 to 2012 (2). In 2012, infants with NAS stayed in the hospital an average of 16.9 days (compared to 2.1 days for healthy newborns), costing hospitals an estimated $1.5 billion; the majority of these charges (81%) were paid by state Medicaid programs, reflecting the greater tendency of opiate-abusing mothers to be from lower income communities (3). NAS often results in prolonged hospitalization and extensive pharmacological therapy and is characterized by a wide array of deleterious symptoms and complications, including increased irritability, hypertonia, tremors, feeding intolerance, emesis, watery stools, seizures, and respiratory distress (4). Extensive research has been conducted on pharmacologic treatment for infants with NAS. Specifically, researchers agree that opiates (oral morphine, methadone) should be first-line treatment

(4). Although nonpharmacological nursing care may be as critical in decreasing withdrawal symptoms in infants with NAS, to date no research has focused on the barriers and enablers to nurses' implementation of nonpharmacological nursing interventions for this vulnerable patient population.

A preliminary integrative review of factors influencing healthcare providers' behaviors in the care of infants with NAS revealed that the inclusion of nonpharmacologic nursing interventions, refinement of NAS assessment skills, and accurate scoring of NAS withdrawal symptoms significantly reduced the severity of withdrawal, length of treatment (LOT), and length of stay (LOS), and improved maternal and infant outcomes (5-7). In contrast, ineffective nursing interventions, inaccurate assessments, and insufficient utilization of abstinence scoring tools contribute to unnecessary pharmacologic treatment, which prolongs drug exposure and hospitalization to the possible detriment of maternal-infant bonding (8).

Because nonpharmacologic nursing care is not complicated by potentially harmful side effects of pharmacological treatment, it should be considered the standard of care for opioid-exposed infants (9). Nonpharmacologic nursing care consists of the careful assessment of mother and infant, provision of caregiving interventions, and the adaptability of environmental and social interactions that support neurodevelopment and physiological stability (9). Mitigating the clinical complications of NAS may improve outcomes such as withdrawal severity, LOT, and LOS, and those that are more challenging to measure, including maternal attachment (10). Further, decreasing NAS infants' LOS by 2 days could result in nationwide savings of an estimated $170 million in hospital charges per year (11).

The purpose of this parallel convergent mixed methods study is to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS through the lens of the Theoretical Domains Framework.

Aim #1: To explore nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS using a descriptive qualitative approach.

a) Conduct semi-structured interviews with up to 20 experienced Neonatal Intensive Care Unit (NICU) nurses who care for infants with NAS.
b) Perform directed content analysis of the interviews, using the TDF as a coding framework to identify specific themes.

Aim #2: To measure nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS using a tailored Determinants of Implementation Behavior Questionnaire (DIBQ-NAS).

a) Administer the DIBQ-NAS to members (n = 367) of the National Association of Neonatal Nurses (NANN) utilizing the NANN *Listservs* resource.

Aim #3: To merge the interview and DIBQ-NAS results to identify and prioritize barriers and enablers to inform future implementation of nonpharmacological nursing interventions for infants with NAS.

Impact

The findings will inform the future development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of this vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

B. SIGNIFICANCE

B.1. The NAS burden to the healthcare system and individuals has reached epidemic proportions.

This study addresses the gap in research on the barriers and enablers to nurses' implementation of nonpharmacological nursing interventions aimed at reducing NAS infants' withdrawal severity and decreasing infants' LOT and LOS. From 2009 to 2012, NAS incidence increased nationally from 3.4 to 5.8 per 1000 hospital births, reaching a total of 21,732 infants with the diagnosis (3,11). During the same time period, the aggregate hospital costs attributed to the care of infants with NAS increased from $732 million to $1.5 billion (11). In addition, admissions of infants with NAS to NICUs increased from 7 to 27/1000 between 2004 and 2013, with an associated increase in the LOS from 13 to 19 days (12). If

pharmacologic treatment was required, the LOS increased to an average of 23 days (11). Evidence has shown that prolonged hospitalization separates the mother from her infant and impairs bonding, an impairment associated with negative developmental and behavioral outcomes (13).

On a global level, this epidemic significantly impacts healthcare systems, as studies have shown in-utero exposure to opioids is associated with intrauterine growth restriction, congenital anomalies, prematurity, low birth weight, and NAS (14). In the US, the federal government promoted the 2015 Protecting Our Infants Act (S.799), with the objectives of improving NAS surveillance programs, addressing research gaps, and implementing effective measures for education, prevention, and treatment (15). The US Department of Health and Human Services determined that gaps in research were related to "the most appropriate treatment and management of infants with NAS" (S.799). This study is designed to inform the future development of educational programs for nurses focused on the implementation of nonpharmacological nursing interventions. Developing educational programs for nurses will aid in establishing a knowledge base that aligns with several objectives of the Protecting Our Infants Act (S.799).

B.2. The implementation of standardized protocols for NAS management is associated with decreased LOS and hospital costs (16,17).

The American Academy of Pediatrics (AAP) Committee on Drugs recommends the establishment of an evidence-based protocol guiding the assessment and management of infants diagnosed with NAS or those at high risk for withdrawal (8). Although current NAS screening, assessment, and treatment methods have limitations, the AAP committee suggests all clinicians be educated on the utilization of published withdrawal assessment tools (8). However, the assessment and care management of infants with NAS varies widely among hospitals in the US, and existing protocols have been based on minimal empirical data (18). In a recent survey of accredited US neonatology fellowship programs, only 55% had implemented a written NAS management protocol, and only 69% used a published abstinence scoring system to determine the severity of withdrawal and inform the treatment provided (19).

In addition, new research findings are often not disseminated to clinicians and therefore not implemented into practice (20). As a result, infants may not receive the recommended course of treatment and may instead receive unnecessary, ineffective, or even harmful therapies (20). This study will identify barriers and enablers to nurses' implementation of nonpharmacological nursing interventions, such as NAS management protocols, which have been shown to reduce withdrawal severity, LOT, LOS, and hospital costs while improving the care of this vulnerable and rapidly-growing patient population (16,17).

B.3. Experts recommend treating the maternal-infant dyad as the standard of care as opposed to treating the infant with NAS alone (21-23)**.**

The nurse's role is to properly assess and interpret the infant's behaviors, determine how the mother understands and responds to her infant, and tailor interventions that help the mother care for her infant (9). However, even though they are well-positioned to have a positive influence on the maternal-infant dyad, nurses often exhibit judgmental behaviors because of negative stereotypes about opioid-dependent mothers (9). In addition, maternal feelings of fear, guilt, and shame related to drug use often limit the mother's ability to have honest conversations with nurses (24). Recent evidence indicates that nurses often lack the required knowledge to provide optimal care to the maternal-infant dyad, a barrier that may also limit the development of nurse-mother relationships (25). To address these problems, research suggests nurses providing care for infants with NAS should receive specialized training that addresses all facets of nursing care, including detailed information on adult addiction and drug use during pregnancy, maternal attachment behaviors, encouragement of appropriate maternal behavior, and breastfeeding when appropriate (24,26). **This study is significant** as the findings can inform the future development of specialized educational programs for nurses focused on the implementation of nonpharmacological nursing interventions, such as supporting breastfeeding when appropriate, caring for the maternal-infant dyad, and promoting nurse-mother relationships, factors that have been shown to improve outcomes for the maternal-infant dyad (9,26,27).

C. INNOVATION

This mixed methods study is innovative because it is the *first* to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS. The utilization of a mixed methods approach, that includes the administration of a tailored Determinants of Implementation Behavior Questionnaire (DIBQ-NAS) to members of NANN, will allow the investigator to gain a comprehensive perspective of the barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS. A *second source of innovation* is that this study will be the first to utilize the Theoretical Domains Framework (TDF) to guide the exploration of certain behavioral constructs of nurses' implementation of nonpharmacological nursing interventions for infants with NAS. The TDF provides a structure for assessing and evaluating the factors that affect the behavior of healthcare providers and the implementation of evidence-based practice (28, 29).

The results of the interviews and DIBQ-NAS will be merged to identify and prioritize barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with NAS. Understanding these factors will aid in the development of specialized educational programs for nurses, which will include all facets of nursing care for the NAS maternal-infant dyad to improve the care and outcomes of this vulnerable and rapidly-growing patient population. This research is critical to establishing a deeper, richer knowledge of the NAS maternal-infant dyad and the nurses who care for this complex patient population.

D. GUIDING THEORETICAL FRAMEWORK

The developers of the TDF identified 33 theories and 128 key theoretical constructs associated with *behavior change* and synthesized them into one framework that can be used to guide theoretical assessment of implementation problems, as well as professional and other health-related behaviors as a basis for intervention development (28). *Knowledge*, *Skills*, and *Social/Professional Role and Identity* were previously identified as the most influential domains relevant to providers' implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS (30). The *Knowledge* domain of the TDF includes the following constructs: knowledge, knowledge about condition/scientific rationale, schemas + mindsets + illness representations, and procedural knowledge (31). The *Skills* domain of the TDF includes the following constructs: skills, competence/ability/skill, assessment, practice/skills development, interpersonal skills, and coping strategies (31). The *Social/Professional Role and Identity* domain of the TDF includes the following constructs: identity, professional identity/boundaries, role, group/social identity, social/group norms, and alienation/organizational commitment (31). In the preliminary integrative review, the primary themes identified within these domains included: knowledge of NAS and AAP recommendations regarding the management of NAS, nursing competence (assessment skills and effective utilization of the Finnegan scoring tool), development of interpersonal relationships with parents within professional boundaries, establishment of role within a multidisciplinary team, and leadership in the management and care of infants with NAS. In addition to the *Knowledge*, *Skills*, and *Social/Professional Role and Identity* domains, this study will investigate other influential contextual and environmental domains related to infants with NAS and the nurses that care for the NAS maternal-infant dyad.

E. DIVERSITY AND SOCIAL DETERMINANTS OF HEALTH

The intent of this study is to obtain a diverse sample of participants with regard to nurses' gender, age, race/ethnicity, level of education and nursing experience. The patient population being served by this study, the maternal-infant dyad, has experienced changes over the past several years with regard to race and ethnicity. A recent study showed an increasing proportion of mothers of white race (from 64% in 2004-2005 to 76% in 2012-2013) and a corresponding decrease during the study period in the proportions of mothers of black race and Hispanic ethnic group ($p<.001$) (12). However, the study also showed no significant changes in maternal age, gravidity, parity, or percentage of mothers who received prenatal care from 2005-2005 to 2012-2013 (12). In addition, the pattern of opioid use has shifted from an inner-city, low-income population to a more socioeconomically and demographically

diverse population that includes pregnant women (32,33). Findings from recent research highlight the critical need to understand the significant increase in healthcare utilization and clinical treatment of infants with NAS in order to define research priorities and design public health programs to improve healthcare delivery for the infants and their mothers (12). The findings from this study will inform future development of specialized educational programs for nurses focused on caring for the maternal-infant dyad and promoting nurse-mother relationships, factors that have been shown not only to enhance maternal self-efficacy but also to address stigmatization, a *Social Determinant of Health*, of the NAS maternal-infant dyad by healthcare providers (34). Further, specialized education for mothers of infants with NAS provided by nurses is an additional *Social Determinant of Health* to be addressed in this proposed study (34).

F. APPROACH

F.1. Preliminary Studies

The principal investigator (PI) is currently completing a small pilot study to explore how nurses and other key interdisciplinary team members perceive the treatment plan and care provided for infants with NAS. The findings from the pilot study will be used to inform and further refine the research design and methods for this study. In preparation for this study, the PI completed an integrative review, guided by the constructs of the TDF, which focused on factors influencing healthcare providers' behaviors in the care of infants with NAS. *Knowledge*, *Skills*, and *Social/Professional Role and Identity* were the most influential domains relevant to modifying healthcare providers' behaviors surrounding implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS.

F.2. Design Overview

This convergent parallel mixed methods study will be conducted through the lens of the TDF. The concurrent timing of quantitative and qualitative strands will allow the PI to equally prioritize each method and utilize two independent forms of data, allowing for greater insight into the phenomena. Quantitative data collection will involve participants' completion of a DIBQ-NAS that measures nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS. In addition, descriptive data from quantitative and qualitative study participants will be collected through brief demographic surveys. Semi-structured interviews will be conducted to provide qualitative data for thematic analysis to describe nurses' perceptions of barriers and enablers to implementation of nonpharmacologic nursing interventions for infants with NAS. The merging of the interview and DIBQ-NAS results will allow for the identification and prioritization of barriers and enablers to inform future implementation of nonpharmacological nursing interventions for infants with NAS.

F.3. Mixed-Methods Methodology

For the purposes of presenting the research design and methods, each one of the three individual aims will be presented individually.

Aim #1: To explore nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS using a descriptive qualitative approach.

Introduction: Semi-structured, individual interviews using open-ended questions will be conducted to explore nurses' perceptions of barriers and enablers to caring for infants with NAS. The PI will request a waiver of signed consent from the Institutional Review Board (IRB) at MUSC. Prior to each participant's inclusion in the study, the PI will explain the full details of the interview procedures as well as the risks involved. Participants will also be informed that they are free to withdraw from the study at any time. Before protocol-specific procedures commence, the PI will explain the aspects of healthcare provider privacy concerning research specific information. Each participant and consenting professional will receive an information sheet regarding the study via email prior to the interview. At the beginning of the interview, the PI will deliver detailed verbal instructions regarding the demographic survey and interview. The PI will ask 8 open-ended questions with probes using an interview guide. Completion of the demographic survey and interview will take approximately 45 minutes.

F.4. Setting

Study participants will be recruited from the Level 2 Neonatal Nursery of the NICU at MUSC. The NICU at MUSC currently employs over 200 nurses and is a state-designated regional perinatal center, providing comprehensive care to healthy and critically ill newborns throughout the state. Each year approximately 2,000 newborns are delivered at MUSC, and an additional 12,000 babies are born within MUSC's referral area. These deliveries generate approximately 900 admissions to the intensive care nurseries. Neonatal transports from outside facilities account for 40% of the total admissions to MUSC's NICU.

F.5. Sample

Purposeful sampling will be used to recruit participants who have experience caring for infants with NAS and their families. The intent will be to obtain a diverse sample of participants with regard to gender, age, race/ethnicity, and level of education and nursing experience.

The PI will recruit up to 20 participants for interviews until theoretical saturation is achieved. Theoretical saturation is the point at which no new information emerges in the data (35). The PI will recruit nurses who have at least 6 months of experience caring for infants diagnosed with NAS (see Table 1). The demographic surveys and interviews will be conducted in person, in a private conference room located in the Children's Hospital at MUSC, or via phone or videoconference according to participants' preference. Interview participants will be recruited from the Level 2 Neonatal Nursery of the NICU and members of NANN who have completed the DIBQ-NAS and selected the option to participate in an interview.

Table 1 – Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Nurses must be licensed and registered to practice in their state.	• Nurses whose primary NAS experience is related to infants withdrawing from opioids/sedatives because the infant is on mechanical ventilation. The type of NAS experience will be evaluated by the PI during the participant screening process.
• For participants recruited from the Level 2 Neonatal Nursery of the NICU at MUSC, nurses must have at least 6 months' experience caring for infants with NAS.	

F.6. Eligibility and Recruitment

Nurses who have at least 6 months' experience caring for infants diagnosed with NAS will be invited to participate in this study. For Level 2 Neonatal Nursery nurses, invitations to participate will be extended via employee group emails, flyers located in staff areas, and monthly staff meetings. After a nurse has expressed interest in participating by emailing or calling the PI, the PI will contact the potential participant, briefly describe the study, and screen for eligibility. Once the nurse is determined to be eligible, the PI will proceed with enrollment in the study. Additional interview participants will be recruited to complete the DIBQ-NAS. Members of NANN will indicate their willingness to participate in a phone or videoconference interview with the PI by selecting an option at the end of the questionnaire. The PI will be notified via REDCap of a participant's interest in completing an interview. The PI will contact the interested member via email or phone to complete the eligibility screening process. Pending study funding, interview participants will be entered into a drawing to receive 1 of 2 $25 gift cards.

F.7. Data Collection

Demographic information on gender, age, race/ethnicity, and level of education and nursing experience will be collected from the participants (Appendix 1). Approximately 20 Semi-structured, individual interviews will be conducted in a private conference room at the Children's Hospital at MUSC, or via phone or videoconference according to participants' preference, with the investigator utilizing an interview guide (Appendix 2). Open-ended interview questions will explore nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS (Appendix 2). The interview guide is designed to yield information related to nurses' perceptions and experiences with caring for infants with NAS; factors they believe impact the infant's length of stay; efficacy and effectiveness of withdrawal scoring instruments; and nurses' perceptions of mothers' responses and interactions with her infant. All interviews will be audio recorded, transcribed using an MUSC-approved transcription service, and entered into NVivo12 software for coding and analysis.

F.8. Data Analysis

The PI will collect data from a number of sources to address the study aims. Interview transcripts will be compared against original recordings to ensure accuracy. Data from participant interviews will be analyzed using conventional content analysis and NVivo12 qualitative data analysis software to code data into common themes. With the TDF as an initial coding framework, the PI will use the constant-comparative method throughout the process of data analysis until theoretical saturation has occurred. The expected outcome of qualitative descriptive studies is a straight, descriptive summary of informational contents of data organized in a way that best fits the data (chronologically by topic, by relevance, etc.) (36). Analytic strategies include: a) coding of data from notes or interviews b) recording insights and reflections on the data c) sorting through the data to identify similar phrases, patterns, themes, sequences, or important features d) looking for commonalities and differences among the data and extracting them for further consideration and analysis e) gradually deciding on a small group or generalizations that hold true for the data f) examining these generalizations in the light of existing knowledge (37).

Data from the demographic surveys will be stored within REDCap and exported to SPSSv22 for analyses. Descriptive statistics will be used to provide basic information about the variables in the dataset and highlight potential relationships between the quantitative and qualitative samples. Descriptive statistics such as, frequency distributions, measures of central tendency (mean, median), and measures of dispersion or variation will be computed on the demographic characteristics (gender, age, race/ethnicity, and level of education and nursing experience) and of the study participants.

Aim #2: To measure nurses' perceptions of barriers and enablers to implementation of nonpharmacological nursing interventions for infants with NAS using a tailored Determinants of Implementation Behavior Questionnaire (DIBQ-NAS).

Introduction: We expect that the demographic survey and DIBQ-NAS will be completed by approximately 400 members of NANN, an approximate response rate of 22%, over the course of 4-6 months. For a 95% confidence interval with a standard deviation of 0.5 and ± 5% margin of error, 367 members of NANN will be needed based on an approximate membership of NANN of 8200 (38). A link to the demographic survey and DIBQ-NAS, administered through REDCap via email, will be sent to the entire membership of NANN; however, initial questionnaire screening will likely reduce the study sample to those who have at least 6 months of experience caring for infants with NAS. A screen, prior to navigating to the surveys, will allow the member to consent to participating in the study. The demographic survey and DIBQ-NAS are expected to take approximately 10 minutes to complete.

F.9. Setting

Study participants will be recruited through NANN, a professional organization of registered nursing professionals at all stages of their careers who care for newborn infants born with a variety of health challenges, including prematurity, birth defects, infection, cardiac malformations, and surgical problems. In addition, participants enrolled in the quantitative component (Aim #2) will have the opportunity to participate in the qualitative component (Aim #1).

F.10. Sample

A database will be developed in REDCap that will include a demographic survey and the DIBQ-NAS. The link to the demographic survey and DIBQ-NAS will be sent via email to more than 8,200 members of NANN using the NANN *Listservs* resource. Approximately 367 NANN members will be needed to complete the survey given a 95% confidence interval with a standard deviation of 0.5 and ± 5% margin of error (confidence interval) (38). Additional interview participants for Aim #1 will be recruited through the REDCap survey by providing the interested member the option to participate in an interview.

Table 2 – Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Nurses must be members of NANN, self-report having at least 6 months' experience caring for infants with NAS, and have access to a computer with a valid email address (for purposes of completing survey instrument via REDCap).	

F.11. Eligibility and Recruitment

Members of NANN will be sent a demographic survey and DIBQ-NAS, administered through REDCap via email, requesting participation by completing the surveys. While there are over 8200 members of NANN currently, the PI will aim to collect data from approximately 367 completed surveys (see Table 2). The DIBQ-NAS will conclude with an option for nurses to express interest in completing a telephone interview with the PI. Pending study funding, participants completing the DIBQ-NAS will be entered into a drawing to receive 1 of 6 $25 gift cards.

F.12. Data Collection

To design effective strategies to improve nurses' implementation behaviors, a valid and reliable questionnaire is needed to assess potential implementation determinants (39). The DIBQ was developed to measure the potential behavior determinants of the 12-domain version of the TDF (40). The initial DIBQ contained 100 items assessing 12 domains. Results obtained from confirmatory factor analysis and Cronbach's alpha resulted in the DIBQ consisting of 93 items assessing 18 domains, explaining 63.3% of the variance, and internal consistency reliability values ranging from .68 to .93. Domains demonstrated good discriminant validity, although the domains *Knowledge* and *Skills*, and domains *Skills* and *Social/professional Role and identity* were highly correlated. The DIBQ, although thorough, is long and tedious and may deter potential participants from completing it.

The PI will utilize a tailored, more succinct version of the DIBQ (Appendix 3) in the proposed study. The tailoring of the DIBQ will be completed by the PI and informed by findings from the integrative review in which *Knowledge*, *Skills*, and *Social/Professional Role and Identity* were identified as the most influential domains relevant to modifying healthcare providers' behaviors regarding the implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS. However, in addition to these 3 domains, other influential contextual and environmental domains will be incorporated into the tailored version of the DIBQ. The original developers of the DIBQ designed the questionnaire to be easily adaptable so it can be used in studies investigating implementation behaviors performed by other healthcare providers in other settings (39). The DIBQ-NAS will consist of 11 questions pertaining to the *Knowledge*, *Skills*, *Organizational Resources and Support*, *Innovation Strategies*, *Perceive Behavioral Control*, and *Social Support* of nurses who care for infants with NAS and their families. The DIBQ-NAS will utilize an ordinal scale to approximate interval properties, such as Likert-type responses to measure nurses' perceptions regarding implementation of nonpharmacological nursing interventions for the infants with NAS. A consistent variable coding strategy will be developed for item responses where lower values represent less confidence/agreement and higher values represent greater confidence/agreement. The DIBQ-NAS is designed to yield information related to the influential constructs and domains of the TDF relevant to modifying nurses'

behaviors regarding the implementation of nonpharmacological interventions aimed at decreasing the LOS for infants with NAS.

F.13. Data Analysis

Rigorous quantitative data analysis procedures will include: a) preparing the data for analysis b) exploring the data c) validate the tailored questionnaire d) analyzing the data e) representing the data analysis f) interpreting the results and g) validating the data and results (41).

The PI will conduct an exploratory factor analysis (EFA) on the DIBQ-NAS to empirically identify dimensionality of the TDF Constructs (*Knowledge*, *Skills*, *Organizational Resources and Support*, *Innovation Strategies*, *Perceive Behavioral Control*, and *Social Support*) utilized in the DIBQ-NAS. The first phase of the EFA will involve transforming the raw data matrix into a correlation matrix to ensure it is factorable, to determine if there are missing data problems that need to be resolved, implement mean or median item imputation if required, and to ascertain that the sample size is adequate (42). The next phase will include identifying the appropriate extraction method (i.e., *maximum likelihood*) to determine the number of factors needed to adequately capture the variance in the set of variables (43). The third phase includes determining how many factors to retain. This phase will likely include the use of *oblique rotation* (i.e., direct oblimin), scree plots, and multiple test runs to determine how many meaningful factors will be in a data set (43). The fourth phase includes determining the method of rotation to transform the original factors so that the results are more interpretable. The final phase will involve interpreting, evaluation, and refining the factors (43).

Preparing the data for analysis will include cleaning data entry errors from the database, and implementing appropriate data analysis procedures when applicable, such as mean or median item imputation, depending on the importance and pattern of the missing data. Exploring the data involves visually inspecting the data and conducting a descriptive analysis (the mean, standard deviation, and variance of responses to each item on the instrument) to determine the general trends in the data. Analyzing the data will involve choosing the appropriate statistical test; analyzing the data to answer the research questions, report inferential test, effect sizes, and confidence intervals: and using quantitative statistical software (SPSSv22) programs (41).

In addition, assuming normal distribution, the PI will conduct an *analysis of variance* (ANOVA), a bivariate parametric test, to draw inferences about differences among the study participants and to determine construct validity of the DIBQ-NAS. However, when comparing only two groups (i.e., gender) the t-test will be used. The independent variables are the demographic characteristics of the participants (i.e., gender, age, race, and level of education and nursing experience), and the dependent variables are the domains and constructs of the TDF (i.e. *Knowledge*, *Skills*, *Organizational Resources and Support*, *Innovation Strategies*, *Perceive Behavioral Control*, and *Social Support*) as they relate to nurses who care for infants with NAS and their families. Further, the PI will conduct chi-square tests to determine inferences regarding the relationship between categorical variables. If the sample size is too small, or determining if the proportions of one variable are different depending on the value of the other variable, a Fisher's exact test will be utilized.

Data from the DIBQ-NAS and the demographic surveys will be stored within REDCap and exported to SPSSv22 for analyses. In addition, demographic data collected during interviews will be manually entered into REDCap and exported to SPSSv22 for analyses. Descriptive statistics will be used to provide basic information about the variables in the dataset and highlight potential relationships between the quantitative and qualitative samples. Descriptive statistics such as, frequency distributions, measures of central tendency (mean, median), and measures of dispersion or variation will be computed on the demographic characteristics (gender, age, race/ethnicity, and level of education and nursing experience) and of the study participants.

The intent is to understand clinical and demographic characteristics of the participants and the constructs of the TDF as they relate to the implementation of nonpharmacological nursing interventions for infants with NAS.

Aim #3: To merge the interview and DIBQ-NAS results to identify and prioritize barriers and enablers to inform future implementation of nonpharmacological nursing interventions for infants with NAS.

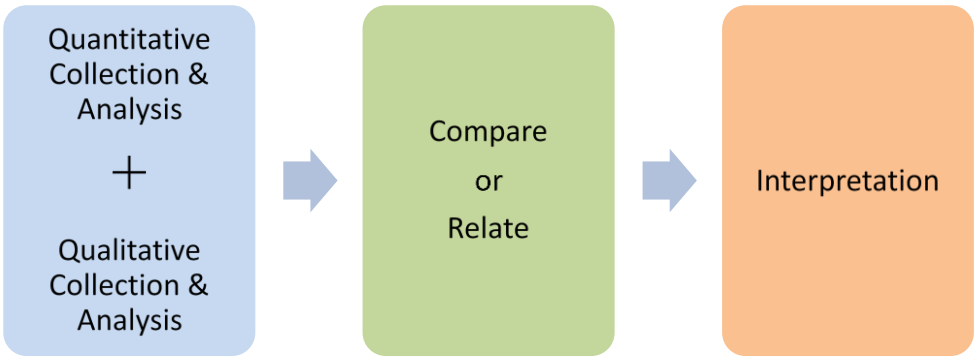
F.14. Data Collection

The findings from the demographic surveys, interviews (from Level 2 Neonatal Nursery nurses and NANN participants), and DIBQ-NASs will be merged and analyzed. It is expected the results will allow the PI to identify and prioritize barriers and enablers to inform future development of educational programs for nurses aimed to facilitate implementation of nonpharmacological nursing interventions to improve the care of the NAS maternal-infant dyad.

F.15. Data Analysis

The results from Aim #1 and Aim #2 will be merged. Data merging involves the joint review of both data types to compare and contrast themes. The data for Aim #1 and Aim #2 will be collected concurrently; however, the data will be independently analyzed using analytic approaches best suited to the quantitative and qualitative research questions (Figure 2). A *joint display* will be the strategy used to array both quantitative and qualitative data so that the two sources of data can be directly compared. The themes that emerge from the quantitative and qualitative data will be categorized utilizing the domains and constructs of the TDF.

Figure 2: Data Analysis of Convergent Parallel Design



F.16. Potential Problems and Alternative Strategies

This study has the potential to be affected by challenges such as inadequate sample size, inability to coordinate interviews due to work schedules, participant fatigue, and erroneous data. In addition, there is the potential for *social desirability response bias* (44) to exist, where participants answer questions with a response they feel is more socially acceptable. To mitigate these challenges, the PI will provide an introduction to the study and extend invitations to participate via multiple venues, such as employee group emails, flyers located in staff areas, monthly staff meetings, and the NANN *Listservs* database. In addition, the PI will schedule the demographic surveys and interviews at the convenience of the participant, to be completed in person, in a private conference room located in the Children's Hospital at MUSC, or via phone or videoconference according to participants' preference. The PI will protect participants against financial risks by carefully scheduling interviews so that work is not interrupted. In addition, the interviews will take approximately 45 minutes to complete and the DIBQ-NAS will take approximately 10 minutes to complete to avoid participant fatigue. The PI will also employ the strategy of creating rapport with the participants, using a comfortable environment conducive to interviews, and educating the participant about the study and how the information collected will be used (44). By mentioning that there is no right or wrong answer and that the data will be carefully secured, the PI will also give participants permission to respond honestly (44). To mitigate the incorporation of incomplete or missing data from the DIBQ-NAS, which may skew results, the PI will implement appropriate data

analysis procedures when applicable, such as mean or median item imputation, depending on the importance and pattern of the missing data.

F.17. Timeline

Table 3 includes the anticipated timeline for completing the primary objectives for the proposed study: IRB approval, participant recruitment, data collection, data analysis, manuscript preparation, and submit for publishing. Aim #1 and #2 will be conducted concurrently.

Table 3 – Proposed Study Timeline

Primary Objectives	Anticipated Date of Completion
• Obtain IRB approval for proposed study	• 6/2018 – 7/2018
• Participant recruitment	• 8/2018 – 1/2019
• Data collection	• 8/2018 – 1/2019
• Data analysis	• 8/2018 – 1/2019
• Manuscript preparation	• 2/2019 – 3/2019
• Submit compendium	• 4/2019

G. Human Subjects

G.1. Risk to the Subjects

a. Human Subjects Involvement and Characteristics

Study participants for Aim #1 will be recruited from the Level 2 Neonatal Nursery of the NICU at MUSC. The NICU at MUSC currently employs over 200 nurses and is a state-designated regional perinatal center, providing comprehensive care to healthy and critically ill newborns throughout the state.

Purposeful sampling will be used to recruit participants who have experience caring for infants with NAS and their families. The intent will be to obtain a diverse sample of participants with regard to gender, age, race/ethnicity, level of education, and nursing experience. For this study, the PI will attempt to recruit up to 20 participants for interviews until theoretical saturation is achieved. The PI will recruit nurses who have at least 6 months of experience caring for infants diagnosed with NAS (Table 1). The interviews will be conducted in person, in a private conference room located in the Children's Hospital at MUSC, or via phone or videoconference according to participants' preference.

For Aim #2, participants will be recruited through NANN, a professional organization of registered nursing professionals at all stages of their careers who care for newborn infants born with a variety of health challenges, including prematurity, birth defects, infection, cardiac malformations, and surgical problems. Interview participants will be recruited from the Level 2 Neonatal Nursery of the NICU and members of NANN who have completed the DIBQ-NAS and selected the option to participate in an interview.

A survey conducted by the National Council of State Board of Nursing (NCSBN) in 2015 indicated that of US nurses, 14.1% were male, 19.5% identified themselves as a racial/ethnic minority, 42% had a bachelor of science in nursing (BSN) as their initial credential, while 65% obtained a baccalaureate or higher degree (in any field) as their highest level of education (45). The intent of this study is to obtain a diverse sample of participants with regard to nurses' gender, age, race/ethnicity, and level of education and nursing experience. The targeted enrollment for this study is representative of the demographics of US nurses identified in the 2015 NCSBN survey.

Targeted/Planned Enrollment Table: Nurses

Total Planned Enrollment: 387 Participants

TARGETED/PLANNED ENROLLMENT: Number of Subjects			
	Sex/Gender		
Ethnic Category	Females	Males	Total
Hispanic or Latino	6	3	9
Not Hispanic or Latino	326	52	378
Ethnic Category: Total of All Subjects*	**332**	**55**	**387**
Racial Categories			
American Indian/Alaska Native	0	0	0
Asian	20	3	23
Native Hawaiian or Other Pacific Islander	0	0	0
Black or African American	33	5	38
White	273	44	317
Racial Categories: Total of All Subjects*	326	52	378

Inclusion of Women and Minorities

Both women and minorities will be included in the proposed study. However, the Level 2 Neonatal Nursery at MUSC (recruitment site for Aim #1) currently employs 2 male White nurses and 4 female African American nurses. The intent for Aim #2 is to gain participant diversification and minority participation through the use of the NANN membership *Listservs* database.

b. Sources of Materials

The only sources of research-related information obtained from human subjects are described in the above research proposal. Data sources include:

- Audio recordings, transcriptions, and field notes from interviews.
- De-identified electronic data from survey information recorded in REDCap.

All data will be used specifically for research purposes. Every effort will be made to keep study records confidential. No identifiers will be used in any reports or publications resulting from this study; however, the data may be used in future studies.

c. Potential Risks

Although we do not expect any significant risks related to the completion of the surveys and interviews in this study, it is possible a participant may experience emotional distress while completing the survey and interview. If necessary, protection against psychological or emotional distress will be provided through debriefing sessions following interviews. In the case of psychological or emotional distress that is not relieved by debriefing, the PI will arrange a referral to a psychologist or psychiatrist. In addition, the participant may choose to discontinue participating in the study at any time. The PI conducting the interviews will monitor the participant for signs of distress and appropriate follow-up will be provided to identify any serious psychological concerns. In the event of a life-threatening emergency, the investigator will call 911.

G.2. Adequacy of Protections Against Risks

a. Recruitment and Informed Consent

For Aim #1, registered nurses who have at least 6 months' experience caring for infants diagnosed with NAS will be invited to participate in this study. For Level 2 Neonatal Nursery nurses, invitations to participate will be extended via employee group emails, flyers located in staff areas, and monthly staff meetings. Additional interview participants will be recruited through the DIBQ- NAS. Members of NANN will indicate their willingness to participate in a phone or videoconference interview with the PI by selecting an option at the end of the questionnaire. The PI will be notified via REDCap of a participant's interest in completing an interview. The PI will contact the interested member via email or phone to

complete the eligibility screening process. Interview participants will be enrolled on a first come, first served method.

For Aim #2, registered nurses who have at least 6 months' experience caring for infants diagnosed with NAS and have access to a computer with a valid email address will be invited to participate in this study. Participants will be recruited through NANN using the *Listservs* resource. Members of NANN will be sent a demographic survey and DIBQ-NAS, administered through REDCap via email, requesting participation by completing the surveys. The DIBQ-NAS will conclude with an option for nurses to express interest in completing a telephone interview with the PI.

The PI will seek a waiver of signed consent, since no interventions are being performed. The Information for Interview/Survey Participants document (see Appendix 4 and 5, respectively) will be provided to participants and will describe the study objectives and contain all other required elements of consent. The document also notes what topics will be discussed, how long the survey/interview process should take to complete, and assurance of confidentiality. The PI has received adequate training in human subject protections, including Miami CITI training. Prior to their inclusion in the study, participants will be informed about the details of the study procedures and protocol as well as the risks involved with participating. Participants will also be informed that they are free to withdraw from the study at any time.

For interview participants, before protocol-specific procedures commence, the PI will fully explain the aspects of healthcare provider privacy concerning research specific information. Each participant and consenting professional will receive an information sheet regarding the study. For participants completing the DIBA-NAS, the first screen of the survey will include the study information for participants and they can select the option to continue to the survey or disagree to exit the survey. All participants will be reminded that every effort will be made to maintain their confidentiality and that they may refuse to participate in the study or withdraw at any time without explanation, and that such an action will in no way affect their status as an employee of MUSC and/or membership with NANN.

b. Protection Against Risk and Data Management

Minimal risk is anticipated for this proposed study. In the event of an unexpected event as a result of participating in the surveys and/or interviews, the participant will be instructed to contact the PI. Based on the study design, it is anticipated that the risk of adverse events (AE) will be acceptably low to non-existent. However, in the event of an AE, it will be recorded and reported to the IRB and investigator according to institutional requirements and procedures. The PI's doctoral advisor will review all AEs.

Several plans are in place for protection of participant confidentiality. The Information for Interview/Survey Participants document (Appendix 4 and 5) assures confidentiality of all information obtained during the study. Confidentiality of participants will be protected by conducting interviews in a private location that will be secured by the investigator prior to the scheduled interview. The confidential data will be de-identified for transcription and analysis. Each participant will be assigned a case number to be referenced on study instruments. The participant identification and enrollment log will also be confidential and filed by the PI in the study file. To ensure participant confidentiality, no paper copies will be made. All reports and communications related to the study will identify participants by assigned case number. All data will be stored in a secure, password-protected REDCap database, in accordance with MUSC's data storage requirements, and the passwords to those files will be accessible to the PI and the PI's doctoral advisor only.

No personal identifiers will be collected; however, email addresses and telephone numbers may be used for the purposes of contacting participants to schedule interviews or to send surveys. Participant contact information will not be connected to any data, and it will be discarded after interviews and surveys have been completed. Breach of confidentiality may be considered an AE, and will be reported to the IRB.

Audio recordings of interview sessions will be uploaded from a portable recorder to password-protected MUSC network storage after which the recordings will be deleted from the portable recorder. Transcription of audio recorded interviews will be conducted by an MUSC-approved transcription

service. The PI will store all transcribed data and study-related documents in a fingerprint-protected safe that will only be accessed by authorized personnel. Data obtained during interviews will be stored in a locked location, accessible only to the PI and doctoral advisor. In addition, caution will be used when presenting interview findings. The intent is to provide adequate quotes and raw data to elicit thick descriptions while avoiding unintentional disclosure of participant identity. Digital audio recordings of interviews will be stored in a secure electronic database for a minimum of 6 years.

There are no social or legal risks associated with participating in this study. Significant efforts will be undertaken to ensure the safety of all participants. The PI will protect participants against physical risks by observing for fatigue and providing breaks when needed. If a participant feels she/he cannot continue with the interview, the interview session will be rescheduled. Participants will be protected against financial risks by scheduling interviews so that work is not interrupted. In the event of study-related illness or injury, participants will be instructed on how to access health care. Participants will be given an information sheet with the PI's name and phone number to contact in the event that there is a problem or if the participant has study-related questions.

G.3. Potential Benefits of the Research to Subjects and Others

Participants will receive no direct benefit from the study. However, the disclosures of the participants will inform future development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of the NAS maternal-infant dyad. The benefits outweigh the potential inconvenience to the participants in terms of anticipated new knowledge gained from this study.

G.4. Knowledge to be Gained

The findings from this study will provide valuable information with the purpose of identifying barriers and enablers to nurses' implementation of nonpharmacological nursing interventions. These findings will also inform the future development of educational programs for nurses that focus on a) the implementation of nonpharmacological nursing interventions, such as, effective infant screening, withdrawal assessment, and utilization of abstinence scoring tools and b) adult substance use, caring for the maternal-infant dyad, and promoting nurse-mother relationships, all of which have been shown to reduce withdrawal severity, LOT, LOS, hospital costs, while enhancing maternal self-efficacy in caring for her infant and improving the care of this vulnerable and rapidly-growing patient population.

G.5. Subject Safety and Minimizing Risks (Data and Safety Monitoring Plan)

The PI will ensure safeguarding of the data through the following actions:

- Weekly tracking of subject accrual (enrollment, demographics)
- Timely and appropriate reporting of protocol deviations, privacy breaches, conflicts of interest, or changes in personnel
- Ongoing daily monitoring of secure data storage

The PI will be responsible for monitoring the study and complying with reporting requirements. The mentoring team will meet with the PI bi-weekly to provide oversight to ensure data safeguarding.

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APPENDIX M. – Protocol for Manuscript 3 (continued)

Appendix 1 – Demographic Survey for Neonatal Nurses

1. What is your gender?

_____

2. What is your age?

_____

3. What is your race?

_____

4. Are you of Hispanic origin?

_____

5. What is your highest degree obtained?

_____

6. How long have you been working as a nurse (in years and months)?

_____

7. How long have you been providing care for infants with Neonatal Abstinence Syndrome (NAS)?

_____

8. How frequently do you provide care for infants with Neonatal Abstinence Syndrome (NAS)?

_____

9. What is the care setting in which you provide care for infants with Neonatal Abstinence Syndrome (NAS)? (i.e., are infants with NAS cared for in a separate unit or in a general service Level II nursery?)

_____

APPENDIX M. – Protocol for Manuscript 3 (continued)

Appendix 2 – Interview Guide for Neonatal Nurses

Opening

Hello, Thank you for meeting with me today and consenting to discuss your professional insight regarding the care provided for infants diagnosed with Neonatal Abstinence Syndrome (NAS).
My name is Allison Adrian, and I am a doctoral student in the nursing research program at the College of Nursing at the Medical University of South Carolina. This interview, a component of a mixed methods study, will be audio recorded, transcribed, and analyzed.

Introduction

Your privacy and anonymity is of utmost importance; therefore, your identity will be kept confidential. Discussing sensitive subject matter, such as the care of infants with NAS, can be emotionally troubling; if at any point during the interview you feel unable to continue, please feel free to stop the interview. We can continue and/or reschedule the interview at your convenience. The interview will be audio recorded for transcription purposes and will last approximately 45 minutes. The audio recording will be destroyed immediately after the information has been transcribed and analyzed. The information gained from this interview will provide insight and rich data regarding nurses' perceptions of providing care for infants with NAS.

Questions

1. Please describe your experience as a nurse caring for infants diagnosed with Neonatal Abstinence Syndrome (NAS).

Prompts

a. What challenges/frustrations do you experience when providing care for infants with NAS?
b. What resources/support do you have available when providing care for infants with NAS?
c. What resources do you feel are needed when providing care for infants with NAS?

2. What factors do you believe impact the length of stay for infants with NAS?

a. What impact do you believe nursing care has on the length of stay for infants with NAS?
b. What impact do you believe the NAS pharmacological protocol has on the length of stay for infants with NAS?
c. What impact do you believe the neonatologists' methodology has on the length of stay for infants with NAS?
d. What impact do you believe parents have on the length of stay for infants with NAS?
e. What do you think would help reduce the length of stay for infants with NAS?

3. What are your perceptions regarding the modified Finnegan scoring tool (F-NAST) in the care of infants with NAS?

Prompts

a. What education did you receive during orientation/training regarding the assessment of infants with NAS and the utilization of the modified Finnegan scoring tool? How would you modify, if at all, the education and/or how it is currently implemented?
b. How confident do you feel in your ability to accurately assess and score an infant with NAS?

Appendix 2 – Interview Guide for Neonatal Nurses (continued)

c. How important do you believe education is in developing a nurses' confidence in their ability to accurately assess and score an infant with NAS?

4. Please describe the hospital's role in supporting nursing care of infants with NAS?

Thank you very much for your responses to my questions so far – I would like to change topics and discuss your thoughts regarding the relationship between the nurse and the mother of the infant with NAS.

5. Please share your thoughts on the role the care provider-mother relationship plays in the infant's progress.

a. Do you feel that stigma exists between nurses and mothers of infants with NAS?
b. Have you ever witnessed a mother being stigmatized by a nurse? If so, please share your experience.

6. Do you think the mother's perception of stigma (whether it exists or not) has an impact on the maternal-infant bond? (i.e., Do you feel it impacts the mother's visiting time, care she provides her infant, her self-confidence in caring for her infant?)

7. Generally speaking, what are your perceptions regarding the mother's responses and interactions with her infant with NAS?

a. Based upon your experience, do you feel mothers are able to bond with their infants? Please discuss your perceptions of facilitators and/or barriers to the mother-infant bonding process.

8. How important do you believe the following factors are in caring for infants with NAS; a nurse's personality, nursing experience, knowledge of condition, knowledge of nursing interventions?

a. Were you taught (nonpharmacological) nursing interventions to calm and soothe infants with NAS?
b. Do you think nurses experience more fatigue and distress when caring for infants with NAS?
c. Do you feel the acuity ranking of infants with NAS (nurse workload) is accurate?

Closing

I greatly appreciate you sharing your perspective regarding this vulnerable mother-infant dyad. Please share any other thoughts or suggestions you may have with regard to caring for these infants or the questions that have been asked during this interview. If necessary, would it be acceptable for me to contact you for clarifications during the transcription and analytical phase of data collection? I will provide you with a brief summary of the findings and major themes identified once data collection and data analysis has been completed. Thank you again for your participation.

Appendix 3 – DIBQ-NAS

Adapted from the DIBQ Final questionnaire

For the purpose of completing this survey, the definition of **"nonpharmacological intervention(s)"** includes the following nursing activities:

- Withdrawal assessment of the infant with Neonatal Abstinence Syndrome (NAS)
- Provision of caregiving interventions; for example, swaddling, holding, breastfeeding support when indicated, non-nutritive sucking, inclusion of the mother in the care of her infant
- Utilization of a withdrawal scoring instrument

1. I know how to deliver nonpharmacological nursing interventions for infants with NAS.
(Domain: Knowledge; Construct: Knowledge)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

2. I have been trained in delivering nonpharmacological nursing interventions for infants with NAS.
(Domain: Skills; Construct: Skills)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

3. I have the skills to deliver nonpharmacological nursing interventions for infants with NAS.
(Domain: Skills; Construct: Skills)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

4. In the organization I work, all necessary resources are available to deliver nonpharmacological interventions to infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

5. I can count on support from management of the organization I work in, when it becomes challenging to provide care for infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

6. The management of the organization I work in is willing to listen to my problems with delivering care to infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

7. The management of the organization I work in is helpful with delivering care and implementing nonpharmacological interventions for infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

Appendix 3 – DIBQ-NAS

Adapted from the DIBQ Final questionnaire

For the purpose of completing this survey, the definition of **"nonpharmacological intervention(s)"** includes the following nursing activities:

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1. I know how to deliver nonpharmacological nursing interventions for infants with NAS.
(Domain: Knowledge; Construct: Knowledge)
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2. I have been trained in delivering nonpharmacological nursing interventions for infants with NAS.
(Domain: Skills; Construct: Skills)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

3. I have the skills to deliver nonpharmacological nursing interventions for infants with NAS.
(Domain: Skills; Construct: Skills)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

4. In the organization I work, all necessary resources are available to deliver nonpharmacological interventions to infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

5. I can count on support from management of the organization I work in, when it becomes challenging to provide care for infants with NAS.
(Domain: Organization; Construct: Organizational resources and support)
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(Domain: Organization; Construct: Organizational resources and support)
_____Strongly Disagree _____Disagree _____Agree _____Strongly Agree

Appendix 4 - Information for Interview Participants document

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

You are being asked to participate in a research study. A study to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with Neonatal Abstinence Syndrome (NAS) will be conducted to inform the development of educational programs for nurses aimed at facilitating the implementation of nonpharmacological nursing interventions to improve the care of a vulnerable and rapidly-growing patient population: the NAS maternal-infant dyad.

We will be recruiting nurses who are familiar with Neonatal Abstinence Syndrome (NAS) and have at least 6 months of experience caring for infants diagnosed with NAS. Study participants will be nurses recruited from the Level 2 Neonatal Nursery at the Medical University of South Carolina (MUSC) and the National Association of Neonatal Nurses (NANN).

Study participants will be asked to complete a demographic survey and interview with the principal investigator, which should take approximately 45 minutes. The interviews will be conducted in a private conference room at the Children's Hospital at MUSC, or via phone or videoconference according to the participants' preference. Study participants recruited from NANN will be asked to complete a demographic survey administered through REDCap via email.

Your confidential participation in this study is voluntary. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad. If you are interested in being a part of this study, or if you would like more information, please call or email Allison at (843) 819-8946 or adrian@musc.edu.

Thank you,
Allison Adrian, BSN, RN
Principal Investigator

Appendix 5 - Information for Survey Participants document

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

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We will be recruiting nurses who are familiar with Neonatal Abstinence Syndrome (NAS) and have at least 6 months of experience caring for infants diagnosed with NAS. Study participants will be recruited from the National Association of Neonatal Nurses (NANN) utilizing the NANN *Listservs* resource. Study participants will be asked to complete a demographic survey and a tailored Determinants of Implementation Behavior Questionnaire (DIBQ-NAS), administered via REDCap through email, which should take approximately 10 minutes.

Your confidential participation in this study is voluntary. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad. If you are interested in being a part of this study, or if you would like more information, please call or email Allison at (843) 819-8946 or adrian@musc.edu.

Thank you,
Allison Adrian, BSN, RN
Principal Investigator

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

IRB Number: Pro00080105
Date Approved: 08/20/2018

Barriers and Enablers to Nurses' Implementation of Nonpharmacological Interventions for Infants with Neonatal Abstinence Syndrome (NAS).

You are being asked to participate in a research study.

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- Your confidential participation in this study is voluntary. Participants will receive no direct benefit from the study. However, the information gained from this study will inform the development of educational programs for nurses to improve the care of the NAS maternal-infant dyad.

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